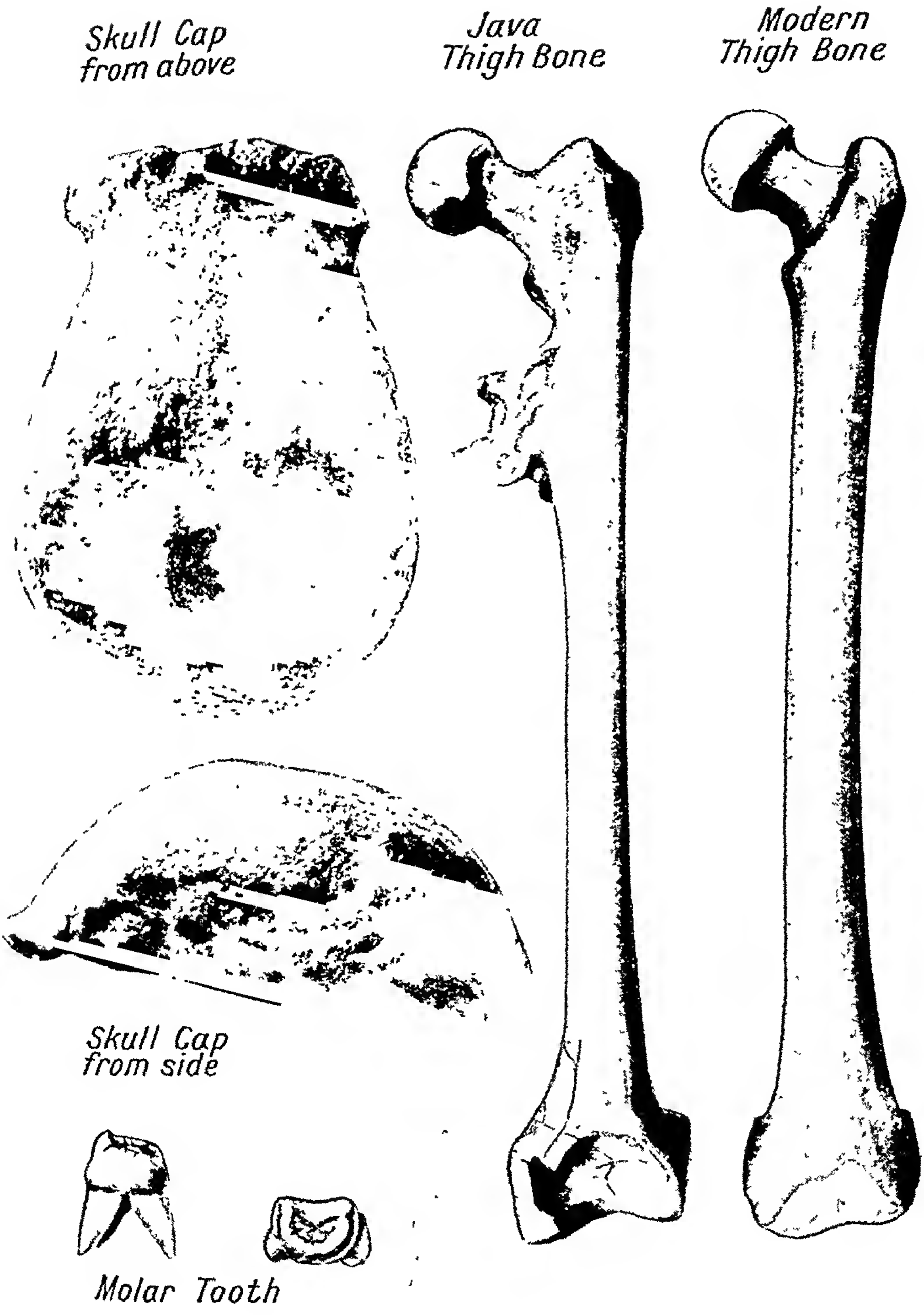
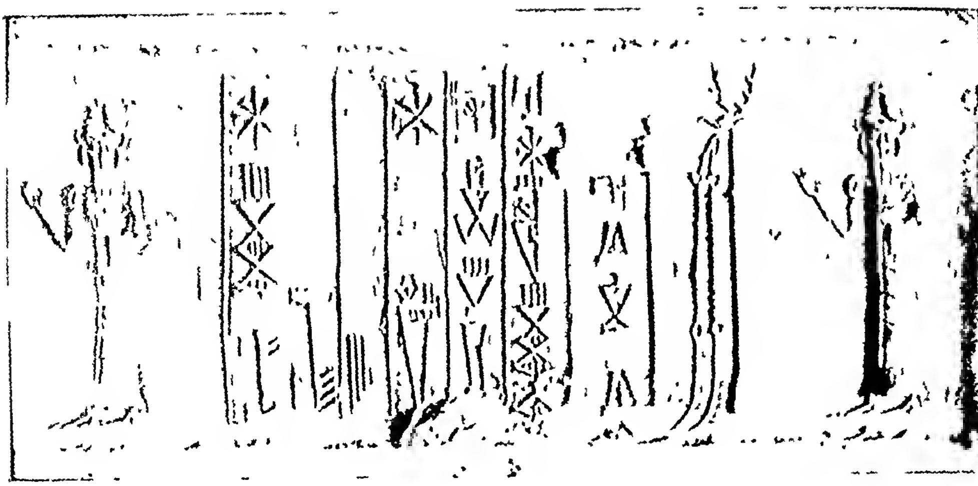
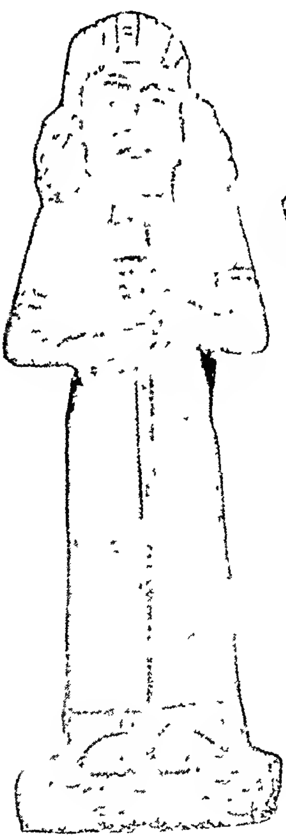
PLATE I


Skull Cap
from above
Java
Thigh Bone
Modern
Thigh Bone
Skull Cap
from side
Molar Tooth

SIXTY CENTURIES OF HEALTH AND PHYSICK

PLATE VIII





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INTRODUCTION

BY

SIR HUMPHRY ROLLESTON, BART.

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THE lay attitude to things medical has changed since the Victorian era; in the last century, in spite of the Scottish proverb that "every man at forty is a fool or physician," there was but little general interest manifested in Medicine and its progress, apart from the individual's anxiety about the ills of his own flesh. What Sir Andrew Clark (1826–93), a prominent London consulting physician, called "the laws of physiological righteousness," were then regarded as something quite unsuitable for ears polite, and conversation on physical disorders was so nearly taboo as to be in no way comparable with that on political, theological, or meteorological disturbances. Now that the ideal of Medicine is recognised to be the prevention of disease, it has become obvious that some knowledge of the laws of health is essential, and that the lay public should be educated in physical as well as in moral and religious well-being. Simple hygiene is now taught in all the State Schools, there are numerous voluntary societies actively engaged in improving the common health, and the Press, which reflects as well as directs public opinion, plays an important part in health propaganda. As Sir George Newman, the Principal Medical Officer of the Ministry of Health and of the Board of Education, said in his address, "Everyman in Preventive Medicine," at the Jubilee Congress of the Royal Sanitary Institute in 1926, "there is no public duty of more consequence than the education of the English people in health of body and mind," and it is a true saying that "the survival of the community is primarily dependent upon physical conditions—the life, health and capacity of the human body." Religion and Medicine—the care of the soul and of the body—were in ancient times combined so that the Medicine was in the hands

of the priesthood, and, though a cleavage took place, the Churchmen preserved their prominent position. Medicine then became allied to science, and, as it shed the trammels of authority and tradition, became more and more an applied science, and has benefited from the enormous advances in science. Formerly, when the curative aspects of Medicine held the field, a little knowledge of Medicine was regarded as, at its best, but a doubtful acquisition, because it might encourage self-treatment and irresponsible drugging. But now, with the realisation of the importance of Preventive Medicine, this argument loses much of its force, and it is perhaps unnecessary to insist at greater length that there is now a growing general interest in the progress of Medicine. That this is desirable in the interests both of the individual and of the national well-being was clearly set out twenty-three centuries ago in Hippocrates' words, "Where there is love for humanity, there also is love for the art" of Medicine. The history of Medicine, and of the natural sciences which are so closely related, is indeed part of history as a whole.

In order to understand properly a man, an art, or a science, a knowledge of their development and past history is essential; what embryology is to the study of man's structure and evolution, history is to the comprehension of an art or a science. It is therefore reasonable that the study of the history of Medicine should have recently attracted increasing attention both in and outside the ranks of the profession. The progress of the science and art of Medicine, for in its different aspects Medicine is both of these, has not been constantly steady; the peaks of medical advance stand out against periods of quiescence and, as in the Dark Ages, even of deterioration. These advances have so often been due to the achievement of great pioneers that it is difficult to separate from the account of the development of the ideas, which is the real function of history, some reference to the personality of these responsible Masters of Medicine. It is, indeed, very tempting to branch off from philosophic ideas to the interesting biographies and the influence leading up to the activities of men such as Hippocrates, Galen, William Harvey, Sydenham, John Hunter, Edward Jenner, Laennec, Claude Bernard, Pasteur, Lister, and Patrick Manson. This difficulty, which increases as the story becomes more modern, is fully acknowledged by the authors of this attractive *Sixty Centuries of Health and Physick*, who accordingly have steered a wise course.

By the use of the old-fashioned word "physick" in the title, the evolution of surgery, obstetrics, and gynæcology has been eliminated from consideration, and attention has been concentrated on what in some countries is often called "internal medicine," to which the physician or "internist" devotes his activities. This course fits in with the scope of the volume, which does not profess to be a complete history of Medicine. But the conventional distinction between "physick" and surgery, of which gynæcology is now a special branch, is fundamentally artificial, for it is not based on any difference in the science of disease, and indeed depends entirely on the form of treatment employed; this may vary from time to time; for example, much that was once within the provinces of the physician, such as intracranial or abdominal tumours, is now rightly excised by the knife; further, some superficial growths usually removed by the surgeon now melt away by radium or X-ray treatment, a method not yet designated either as surgical or medical. In tracing the evolution of "physick" from primitive magic to modern medicine the authors have successfully brought out the importance of the preventive idea which should permeate the teaching, practice, and research of the Medicine of the future.

PREFACE

In these pages we are to follow in outline the evolution of ideas in the long quest for health from the earliest evidences of disease to the modern expansion of scientific medicine. Always it is the progress of ideas (and medical ideas, not surgical) and not a collection of historical incidents, with which we are to be concerned.

So we shall follow the dim traces of medical and hygienic ideas among primitive men, see their gradual slow emergence from the cast and matrix of magic and superstition in the earliest civilizations, herald the appearance of true hygiene in the marvellous sixty-century old Sumerian culture, and consider the remarkable mixture of commonsense and magic in Assyrian and Egyptian therapy. Then we hail the flowering of sane medical practice among the masters of art and science—the Greeks—paying due and wondering reverence to the great Master, Hippocrates. The Roman world produces no new ideas but keeps the Greek in bond, and is content to organize triumphantly, so that we see general medical services and military hospitals on a material scale.

Then the darkness descends, and all knowledge and science of four millennia are lost. Europe welters for a thousand years in gross magic and superstition until, with the first stirrings of re-birth of humanism, the Arabs are found to have preserved something of the "true faith" of medicine, and with the Renaissance medical science lifts up her head again, somewhat dashed by the great plagues of the thirteenth to seventeenth centuries, the Black Death and other epidemics, those constant enemies, against which little availed.

The fifteenth and sixteenth centuries break away from precedent and see the spread of original ideas, while the seventeenth sees the conscious application of scientific methods, and, with the great Sydenham, Hippocrates returns and clinical medicine is refounded. The eighteenth goes yet farther and opens the modern epoch with the establishment of preventive medicine,

definite pathology, public hygiene and public hospitals. Medicine and its allied sciences expand amazingly when we enter the Golden Age of the nineteenth century.

Our necessarily rapid survey ends with a note on the great conquests and greater hopes of medicine to-day.

Certain names must inevitably stand out in the course of our reading for they are the names of great men, but primarily we are concerned with ideas not names. As the conventional school history of earlier generations made itself dull, and in the result uninforming, by presenting a catalogue of king-names and left us unaware that the common people existed, so the history of any science or branch of knowledge loses reality if it is content to recite a merely chronological series of biographies of individual scientists.

Often the great man of a discovery or period of marked advance is he who puts the coping-stone on the building of others. The great discoverers themselves with few, if any, exceptions do not fail to acknowledge that without the work of their predecessors and the urge of the "spirit of the time" their achievements would not be possible.

In particular, the latter part of the work has been written on the avowed principle that it is impossible to present the seventeenth, eighteenth or nineteenth centuries in detail and yet retain the spirit of the age. A forest of names is no satisfactory substitute for the particular shaft of sunlight across the woodland ride. Reference to any of the great Histories of Medicine will leave the lay reader dizzy with the cumulative effect of names that have contributed to the progress of medicine but will mean nothing to him in memory. He will also constantly be tripped up by technical matters which it is neither possible nor particularly important for him to grasp.

The method followed in this work is to seize the prevalent ideas of each age of medicine with some notes on the public health, to present them with due regard to the colour of the age, and ruthlessly to ignore minor names. All life is founded on thought. It is greater than the thinker, because it spreads and fecundates the surrounding country. The group of thinkers departs. Their thought moulds progress.

Thus, though those familiar with the bypaths and remoter details of the long record of medicine will find many omissions in this volume, all that the writers have cared about is that the reader should put it down with a clear idea of the progress of medicine and some notions on that of hygiene. They have not

hesitated, where necessary, even to forsake the path of medicine proper if to do so sheds a fresher light on the journey.

They have also considered it of value and assistance to the ordinary reader, unable or unlikely to consult original authorities or to wade through copious tomes in search of the significant, to give considerable but careful selections of the actual words of the greater figures of medical history. Moreover, the reader is thereby assisted in making his own valuation of those figures who, in this way, can be given life much warmer and closer than any description at second-hand can afford.

So the reader is not to expect a comprehensive study of the History of Medicine. That has already been provided in many learned volumes. Nor is he to expect anything but a medical and hygienic study. The other and perhaps more important aspects —anatomy, biology, physiology and surgery—will, it is hoped, be dealt with in a companion volume. While the authors do not pretend to appeal to the learned student and the medical historian, it is incumbent upon them to acknowledge their indebtedness to the researches and writings of the original workers and to point the way for those who wish to pursue wider and deeper studies.

Among the great debts which the authors have to acknowledge is the courtesy of Dr. R. Campbell Thompson, the Assyriologist, who has not only permitted one of us to draw largely on his great corpus, the *Assyrian Medical Texts*, which are accessible only with great difficulty to the layman, but has very kindly read and corrected the chapter on ancient Mesopotamian medical and hygienic ideas, and so given it an "imprimatur" of great authority. Mr. W. H. S. Jones, Litt. D., President and Classical Lecturer of St. Catharine's College, Cambridge, has most kindly and generously permitted the use of extracts from his translations of Hippocrates in the Loeb Classical Library, including the "Aphorisms," which were not published when the book was printed. Acknowledgment is also due to the very helpful courtesy of Mr. Warren R. Dawson, one of the principal authorities in this country on Egyptian medicine and medical papyri. No one who writes anything which touches on any branch of medical history can fail to be indebted to Dr. Charles Singer, the erudite Lecturer in the History of Medicine, in the University of London.

Similarly acknowledgment is due to Dr. E. T. Withington, author of that entirely original and pioneer work, *Medical History*, now almost unobtainable; and to Dr. Fielding

H. Garrison, author of the monumental *History of Medicine*.

The division of labour is a matter of relative unimportance to the reader, but we think it fit to put on record that the first name on the title page carries responsibility for all matter up to the end of the sixteenth century (Chapters I to X and XIX) the remainder lying with the bearer of the second name, whose thanks are due to the Very Revd. Canon G. R. J. Fletcher, M.R.C.S., for his most kindly help in making special journeys to Farm Street and the British Museum to obtain, during the author's absence from London, passages from Kircher; to Mr. Arnold M. Muirhead for his translation from Kircher; to Dr. John Farquhar Fulton for looking over the chapter on the Oxford Respirationists, and for many kindnesses; to Dr. Hubert J. Norman, whose wonderful library and whose friendly portals have constantly been open to him: for assisting him, if he may so put it in the good, the Saintsbury, sense, *libris non sine Libero*; to Professor Clifford Dobell, F.R.S., for two helpful letters; and to Mr. Adrian Bury, without whose encouragement he would hardly have taken up pen.

The thanks of both authors are due to their friend, Mr. H. E. Powell, Librarian of the Royal Society of Medicine, for much invaluable criticism. Acknowledgment for assistance in the provision of illustrations is due, among others, to Dr. Charles Singer, to the Editor of *The Universal History of the World*, to Mr. G. P. Forrester, Editor of *The Chemist and Druggist*, and to Mr. L. W. G. Malcolm, Curator of the Wellcome Historical Medical Museum.

Fetcham, and Midhurst, 1931.

LIST OF PLATES

PLATE I

Bone Tumour of the First Man

Java man, the earliest type of ape-like man known (*Pithecanthropus erectus*), suffered from a tumour, or exostosis, of the thigh bone. The fossil bones shown in the plate are all that were recovered by Dr. Dubois, at Trinil, in Java, in 1891. *Sinanthropus*, found at Peking in 1929, is probably contemporary.

After Eugene Dubois; From "The Universal History of the World," Amalgamated Press, Ltd.

Plate II

PLATE II

Forms of Prehistoric and Primitive Magic

The Aurignacian (*c.* 11000 B.C.) used magic (as distinct from sorcery or witchcraft) for hunting and other purposes. The painting from the Trois Frères Cave, Ariège, France, known as "The Sorcerer", shows a man in mixed animal disguise, a fairly clear case of sympathetic magic.

Courtesy of Mr. M. C. Burkitt.

The 'pointing bone' of the Australian aborigines is supposed to have magic powers of inducing disease in the man towards whom it is pointed. This example, in red wood, was used by the Warara tribe, Port George IV and Glenelg River District, Kimberley.

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SIXTY CENTURIES OF HEALTH AND PHYSICK

CHAPTER I

PRIMITIVE NOTIONS OF HEALTH AND DISEASE

THAT THE intelligent man desires health above all boons is a platitude and a fundamental truth. The fact that health is to be sought for implies the fact of disease. The romanticists of the Rousseau school have postulated a Golden Age and a Noble Savage before civilization had laid its sophisticating and destroying fingers on Nature, healthy, happy and effortlessly wise. Science coldly brushes aside this figment and announces that germs, which we associate with disease, are as old as earthly life itself, and that bacteria and perhaps bacterial disease can be traced back to the Carboniferous Period, when the coal measures of central and northern England were laid down, some 160,000,000 years ago according to geological and physical calculations.

This figure is necessarily an approximate estimate, since though the physicists have, on radioactive data, assigned a total age for the Earth of between 1,500,000,000 and 2,000,000,000 years the geologists and the palæontologists are not agreed upon the time duration of the various Eras. The geologists are in general agreement as to the relative duration of Eras and Periods, but they are content, for lack of a geological time scale, to leave the time allotment to the physicists. Other scientists, including many zoologists, are unable to accept the length of period required by physical considerations. On the physical bases, for instance, the Tertiary or Era of Recent Life, has been allotted some 30,000,000 years while the zoologists are only prepared to give it 2,000,000—a discrepancy, large as it is, that is not unreasonable in the present state of knowledge. On this basis Sir Arthur Keith refers the most ancient remains

of man to only about 350,000 years B.C. This may be regarded as a minimum. Others place them about 3,000,000 or more. In any event disease is far older than man, while the quest for health is obviously far younger.

Nevertheless, there is no evidence to show that disease was a factor of real importance before man appeared. A few isolated cases have survived. A number of fossil bones of extinct animals are found to show signs of disease (apart from injuries), as in the case of the dinosaur with a bone tumour, said to be the earliest known example of this disease. A still earlier reptile of the Permian Period fractured a dorsal spine, which became infected and developed a chronic inflammation of a kind known to-day as osteo-myelitis. According to Professor Roy Moodie this is not only the oldest example of this condition, but is the oldest vertebrate fossil known which shows the results of infection. This carries disease in a form known to and still suffered by human beings back to some 130,000,000 years ago on the physical basis of computation or, say, 8,000,000 on the zoological basis.

A theory which held the field for some time assigned the apparently sudden disappearance of the race of enormous reptiles called dinosaurs to epidemic disease, but, while this is a possible cause, there is a lack of geological evidence either in support or in opposition. Many of the modern epidemic diseases, with high mortality rates, leave no traces in the bones, and the dinosaur race may perhaps have been extinguished by such a disease. In this same dinosaur period, however, we do find evidence of infective processes such as rheumatoid changes, osteitis (jaw bone inflammation) and dental decay. A 40-foot dinosaur with jaws nearly three feet long suffering from toothache offers obvious possibilities to the comic artist.

These and other pathological conditions in pre-anthropoid fossil remains were of course due to bacterial infections and it is an astonishing fact that the minute forms of protoplasm called bacteria have been preserved in fossil specimens over an almost incredible number of millions of years. The researches of M. Bernard Renault have proved the presence beyond doubt of bacteria of the micrococcus and diplococcus types in various forms of coal, in the fossilized fæces of fish and in vertebrate remains, all of the Carboniferous Period. How they were preserved remains a palæontological puzzle.

When we come to the question of disease in prehistoric man and, what is more important to our inquiry, its treatment, we

are still on difficult ground. The pathological evidence is similar to that which we have discussed above, and as scanty, since it is equally limited to bone changes.

On the medical side there has been much argument and theorizing from what the attorney called "the nature of the case" and from the promising though somewhat dangerous parallels supplied by modern primitives. A race like the aborigines of Central and North-western Australia is found to be using flint tools and weapons, and is dubbed Stone Age; but although it is an accepted principle, in any investigation, to argue from the known to the unknown, it does not necessarily follow, when the two are separated by many millions of years, that the later known supplies reliable evidence of the much earlier unknown. Although we shall consider the possibilities of elementary medical knowledge acquired by prehistoric man by perhaps painful experience, and although it will also be fitting in this chapter to note one or two outstanding examples of medical and hygienic practice among modern primitives, it is desirable to emphasize that knowledge of actual prehistoric medicine is practically non-existent.

To take the geological evidence first. Every textbook of palæontology dilates on the skill of prehistoric man in various forms of surgery, particularly trephining of the skull, which was widely performed in Neolithic times. Surgical matters, however, are outside our scope in this work, and we proceed to consider the human fossil remains which show signs of disease.

The first is the first creature with human characteristics which has so far been found. Pithecanthropus, the Java ape-man, whose skull, three teeth and one thigh bone were discovered in 1891, suffered from exostoses or bony outgrowths of his thigh bone, which made a tumour so large as to have inconvenienced him considerably [Plate 1]. Pithecanthropus belonged to the Pliocene Period and, according to Sir Arthur Keith's dating, is about 350,000 years old (i.e. the first certain human type). Such outgrowths of bone are not uncommon to-day, an interesting example being the rider's bone sometimes developed by men who spend much time in the saddle. It is a little ironic that even the earliest man known should not be without disease.

In the late Stone Age (Palæolithic) and Neolithic races we find many cases of fracture and diseased conditions following injury. Spondylitis deformans, a diseased and painful stiffening of the spinal joints and a progressive deformity, has frequently

been found. A Neolithic grave, near Heidelberg, produced a skeleton showing the oldest case of Pott's disease, i.e., tuberculosis of the spine. Curvature of the spine, skull ulceration and many varieties of arthritic afflictions have also been found. The great pathologist Virchow investigated and described a number of instances of arthritis in Glacial times.

Though dental caries (decay of the teeth) has been considered to be a purely modern disease, and certainly was not common in men of the Stone Ages, yet examples do occur, as in the Neanderthal jaw found at Krapina, which showed clear signs of caries and tartar with arthritis deformans in addition. Rhodesian man (who represents, according to Keith, the stem from which both Australoid and Negroid man afterwards developed) suffered severely from caries and dental abscess. The skeletal remains found at Broken Hill showed ten teeth which were decayed and, significantly enough, rheumatoid changes in the left knee.

There is no room for doubt that caries is essentially a modern disease associated with modern soft foods which have altered and constricted nasal passages, jaw and palate shapes. As Sir Arthur Keith points out, in modern man 'there is a tendency to crowding and irregularities of the teeth; the palate and jaws do not grow and expand sufficiently . . . to give room for a symmetrical eruption of the teeth. . . . The teeth are not worn down [by coarse foods and bone-gnawing] as in Neolithic men. . . . The front teeth . . . do not meet edge to edge as in primitive races. . . . In the Neolithic people all these modern characters are absent. Abscesses or gumboils at the roots of the deeply ground teeth, however, were common; but there is not a single carious tooth to be seen in the Coldrum collection' [of Neolithic bones]. The wild chimpanzee is but slightly subject to this affliction, and the Australian aborigines almost entirely free, although they appear to succumb to it when they adopt the white man's diet.

Although he escaped most, if not all, of the modern dietary diseases it is clear that prehistoric man was faced with a variety of diseases, and it is hardly possible to suppose that individuals made no attempt to deal with these conditions. An animal when it is sick goes away by itself and waits for nature or death to relieve its distress. But if early man developed the intelligence necessary to fashion his really remarkable flint tools and weapons it is not unreasonable to argue that he would devise or discover some therapeutical methods of dealing with

sickness, as we know he did in surgical conditions. Necessarily direct evidence is lacking, but a cautious application of parallels supplied by modern primitives may indicate possibilities worthy of consideration.

First comes the most obvious form—treatment by faith healing, generally considered by anthropologist or tribesman as magical or magico-religious, that is, some supernormal power as distinct from sorcery. When man began to think more or less consciously he would, as do the modern primitives, put on one side and label as magical or divine all the phenomena which he neither understood nor connected with simple causes.

The display of natural forces, such as thunder, storm winds and waterfalls, are obvious examples where the inherent magic is mixed with or even superseded by a religious element. In fact, Dr. Rivers was of opinion that the religious element in medical rites and leechcraft in all times has been under-estimated. So also is Dr. Marett. Medicine-man and priest are mingled in many, if not most, native cults. So we get the priest-king and the long survival of healing powers resident in the royal person and touch. Where disease or injury is ascribed to magic it is often said among primitive peoples, particularly those of the Pacific Islands and the Australian continent, to be due to hostile magic, i.e. witchcraft exercised by human agency in the person of a sorcerer. In other peoples, as in the European medieval period, it is due to evil spirits whose name is veritably legion.

Magic as a positive method in attacking the difficulties of life is perhaps as old as the recognition of disease. The marvellous paintings in the caves of the Dordogne and Eastern and Northern Spain provide definite evidence that Aurignacian man, some ten or twelve thousand years ago, used magic in his hunting, and it is hardly possible to assume that the magic, which was so powerful in providing his daily food, would not also be effective in other directions. The extraordinarily high artistic level of these paintings in dark recesses of deep caves (some critics are of opinion that, as examples of animal life studies, later art has never surpassed them) indicates too keen an intelligence to support the idea of so restricted an outlook.

The Australian aborigines consider that all sickness and accidents, if not due to the individual's own fault, such as breaking rules of conduct or tabu, are caused by hostile magic. A man's enemy points a poison bone [Plate 2] or stick at him at a distance, and this bone is invisibly sent into him by magic. The medicine-man, who possesses magic healing crystals [Plate 3], cures

him by gazing fixedly at him, thereby projecting the healing crystals into him. Then he lies on his patient, massages him, and little by little sucks the "poison bone" out of [Plate 4]. As in many other native races, the importance of faith on the part of doctor and patient is shown by the fact that if the medicine-man declines treatment because he fears failure, or the patient is convinced that he has suffered a fatal hostile magic, the patient often quietly lies down to die.

Dr. Rivers, in his *Medicine Magic and Religion*, points out that in addition to treatment by the specially qualified witch doctor or medicine-man, primitive peoples possess remedies of the "domestic" order which may be applied by anyone when the case is not sufficiently serious to demand the specialist's attention. He instances the Kai of N.E. New Guinea who, in addition to a complex ritual involving the expert services of the sorcerer, make use of such simple remedies as palm-fruit poultices for wounds, bleeding for headaches, leeches for local pain and vapour baths for rheumatism.

Similarly Mr. W. E. Roth (Northern Protector of the Aborigines, Queensland) has shown that the Australian aborigines, whose culture is supposed to have been free from all contact with civilization before the eighteenth century, although it probably has suffered degeneration, have knowledge of the properties and uses of a respectable variety of simples, a number of which on investigation are found to have genuine medical properties. As with other modern primitive peoples the "domestic" remedies are applied before the magical.

"To combat such diseases as are not wilfully produced by enemy action, witchcraft, doom, etc., remedies are applied as chants, amulets, ligatures [of human hair or opossum fur tied casually on ankles, legs or elsewhere] sucking strings, medicines (liniments), lotions [of blood, snake fat or plant decoctions], etc. . . . All complaints may be so treated. Only when the treatment eventually fails . . . the true cause is discovered, the particular charm recognised and the medicine-man called in." —(*Roth.*)

Among the medicines referred to above Mr. Roth identified forty-two vegetable remedies, twenty-five of which were for internal use. Included among them was *Colophylum inophyllum*, the nut kernel of which, ground and mixed with water, was applied to a pain spot. The oil of this nut is regularly used in India as a rheumatism application. Their use of the juice of young shoots of a fig (*Ficus scabra*) for healing wounds was found

efficacious by independent test. Six varieties of eucalyptus bark or gum were used for constipation, dysentery and fevers. The white men of a N. Queensland district followed the aborigines' example in using a decoction of the leaves of *Grewia polygama* for dysentery. Australian mint they used reasonably enough for coughs and colds, and a plant known as *Ocimum sanctum* (Holy basil), well known in India and Ceylon as a stimulant and diaphoretic (sweating inducer), they used for fevers and sickness.

These few tested examples at least demonstrate that primitive men can acquire useful and sound medical knowledge, overridden though it may be with magic and superstition. If there is one fact brought out more clearly than any other in the history of medicine it is that magic and superstition are inevitably and inalienably associated with it in all civilizations and in all ages with a few brief centuries of sanity standing out, such as the fifth and fourth of the Greeks, the first B.C. and the first A.D. of the Romans and—dare we claim it?—our own eighteenth, nineteenth and twentieth.

On the other hand the parallelism with prehistoric man is slightly strengthened by Sir Arthur Keith's statement that the brain of the Australian aborigine is but little superior to that of the Dawn Man (Eoanthropus—somewhat later than Pithecanthropus, discussed in page 3).

Up to this point, though we have glanced at Neolithic and have mentioned Aurignacian man, we have been mainly concerned with men of the Old Stone Age.

When we leave early Palæolithic man and the last of the great Glacial Periods, Neanderthal man has disappeared and Aurignacian man, the first modern man in Europe, appears—probably from Africa. Some three thousand or four thousand years pass and with a partial return of colder conditions we find the Magdalenian culture succeeding and continuing the Aurignacian, and we are, in Western Europe at least, in a more or less loosely defined society of hunters and food-gatherers whose manners and methods of life have been well described by Mr. H. J. E. Peake and Professor H. J. Fleure.

This modern type differed from the older extinct types of men, particularly in the greater development of the fore-brain which gave them longer heads and brains of a definitely superior kind. They continued to hunt and gather food for several thousand years until agriculture spread into Europe from Egypt or the Near East, where it had been invented some three thousand years or more earlier. Their life was more varied and their

knowledge wider. They knew, for instance, the position of the heart of the bison. Whether in caves, river terraces or the open grass-lands they formed definite communities and increased care of the sick and injured may be postulated. Professor Fleure has pointed out that Aurignacian infant skulls show a delay in the closing of the sutures which not only permitted increased brain growth by enlarging the skull capacity, but suggests something in the nature of child welfare, since the period of infancy must have been prolonged. They not only believed in magic for hunting purposes (as indicated earlier), but in personal magical powers, if the painting in the Trois Frères cave, at Ariège, of a man in composite animal disguise is correctly interpreted as representing a magician.

These food-gathering peoples necessarily had experience of all kinds of fruits, berries and edible grasses and plants, and though it is a matter of inference rather than precise evidence it seems indubitable that they discovered by painful experience that some berries and plants were not only unpleasant but poisonous. Professor G. Renard, in his *Life and Work in Prehistoric Times*, concludes that "in different countries and in different times man discovered tea, coffee, maté, cocoa and the kola nut, all plants which were used by uncivilized peoples before being adopted by the civilized. One must also mention the poppy from which opium comes, hemp which produced hashish, and coca which produces cocaine. Man seems to have discovered the properties of these very early, a knowledge which remained the property of priests, sorcerers and medicine-men."

With the return of the colder conditions referred to above, and the great climatic changes which followed the final retreat of the ice, European man gradually became more scattered and impoverished owing to the increasing reduction in natural food supplies. The hunting societies died out some time after 5000 B.C., and the centre of interest shifts to Egypt and the Near East.

From the brief study which we have made of early man we may credit him with a higher level of health than the products of most civilizations, although his ideas of medicine and health appear to be but a crude mixture of the animal and animistic.

PLATE III

AUSTRALIAN MEDICINE MAN WITH MAGIC HEALING CRYSTAL

This is a type of the medical magic, seriously applied, which many primitive races practise after the ordinary domestic remedies have been used without success. The healing crystal, the Oruncha, is invisible and imaginary, but this does not detract from its magic powers. The body markings are magical and represent healing crystals.

From Spencer and Gillen "Across Australia," Macmillan & Co., Ltd.

PLATE IV

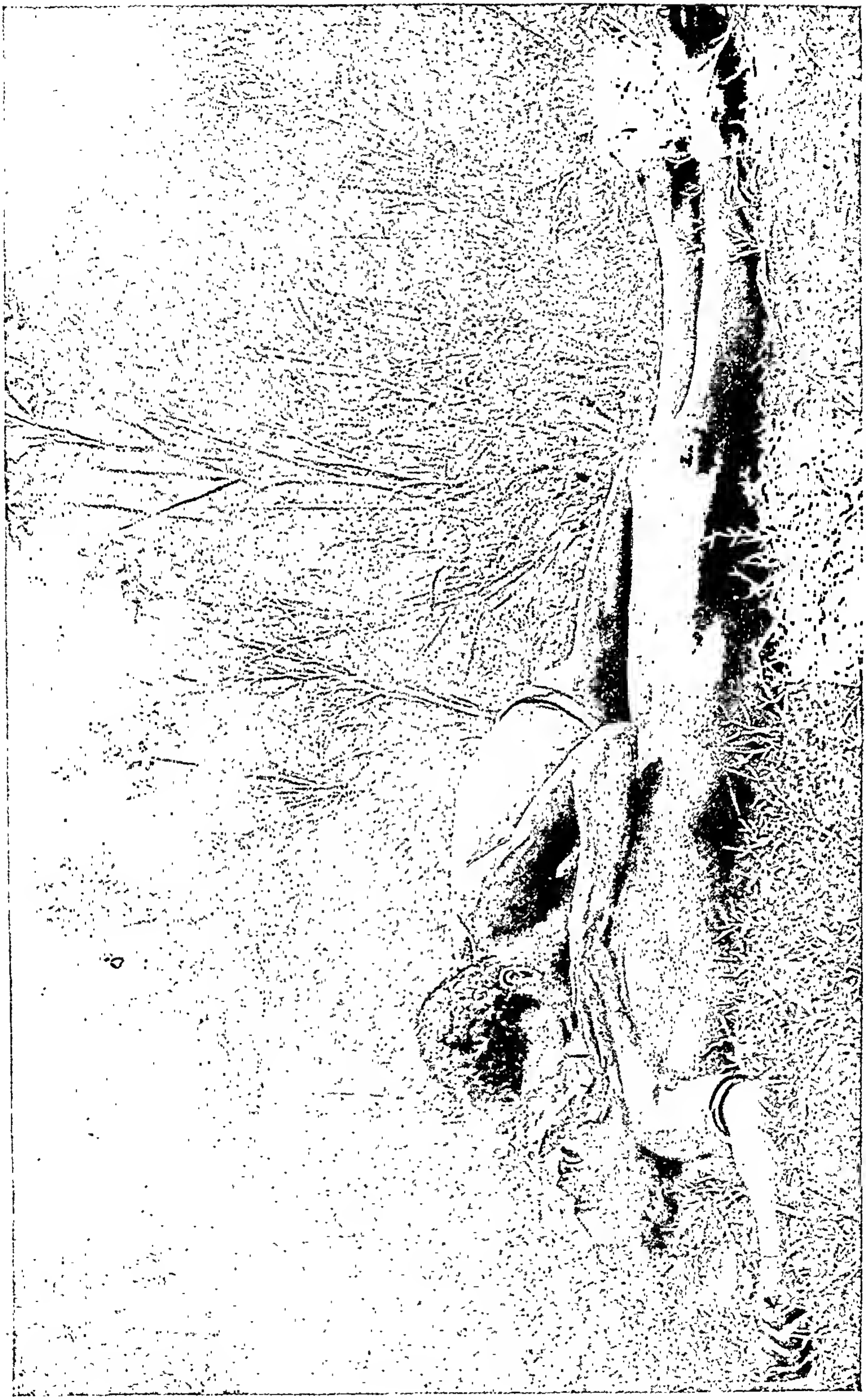


PLATE IV

Australian Magician Cures his Patient by Sucking out the Evil Witchcraft

To the Australian, and many other primitive races, disease is due largely to hostile magic, as by pointing a "bone". The medicine man treats it first by projecting the invisible magic crystals (*see* previous Plate) into the patient and then, after massage, by sucking the invisible poison bone out, as in this Kakadu example. Similar practices are found in Melanesia.

Sir Baldwin Spencer in "Handbook for Australia," 1914.

CHAPTER II

ACHIEVEMENTS AND SUPERSTITIONS OF SUMERIANS, BABYLONIANS AND ASSYRIANS

ONE OF the difficulties of a sketch of any section of civilization lies in the fact that the sequence of civilizations is not an ordered affair like a railway timetable. Civilization in Europe in the sense in which we know it was a much later affair than in the East. After the disappearance of the food-hunters various stages of culture developed in different areas at different times. Neolithic (New Stone), Chalcolithic (copper and stone) and Bronze and Iron Ages endured and were succeeded at unequal intervals, so that while some peoples were still using stone implements others were well advanced in the use of copper and its alloy, bronze. So the Bronze Age in Scandinavia is contemporary with the fully developed Iron Age in Central Europe. None of these cultures, interesting though they be, was so highly developed or so important in the history of civilization, or in the subjects of our study, as those of the Near East and Egypt. It is true that, as we have already mentioned, Neolithic peoples showed surprising skill in some forms of surgery. So also did the men of the Bronze Age, but in both cases we have no knowledge to lead us to suppose that their ideas of medicine and hygiene differed considerably from those of the primitive peoples of Palæolithic times.

So we leave these somewhat rude peoples of barbaric Europe who cover, generally, the period from about 7000 B.C. to 600 B.C., and turn to the Near East somewhere about the end of the fifth millenium B.C. about the time when, it will be remembered, the primitive food-hunting societies of Europe died out. The question may be asked—Why begin with the Near East instead of Egypt? It is certainly the fashion with the older schools of historical writers, and a dogma held almost passionately by one modern school of anthropologists, that first in time and first in importance was Egypt and that from Egypt came all. *Ex Aegypto lux*, to vary the tag. But the majority of scholars are unable to accept this diffusionist theory of culture and consider that

South-west Asia was the original home of civilization. We shall therefore discuss first the Near East—Mesopotamia, and its related cultures.

Mr. C. Leonard Woolley, the well-known excavator of the ziggurat and cities of Ur, considers that the objects he has uncovered in his diggings show that the Sumerian was not only a magnificent craftsman in metal when the pre-dynastic Egyptian was making fine flints, but indicate a craft tradition and an elaborate system of trade that must have had their roots in a period many hundreds of years earlier.

The Sumerians were established in Babylon some time after 5000 B.C. and already by this time, if not earlier, an ordered civilization had been achieved, for they organized a kingship with dynasties grading from traditional to actual at Erech, Ur, Kish, Lagash and other centres. The monarchical development may perhaps be gauged by the fact that, as Mr. Woolley has discovered in the great Death Pit at Ur, when the king (or other members of the royal household) died, his gaily clad retinue of nobles, ladies, servants and oxen accompanied him to the next world of which they obviously had a clear and certain idea.

That they accompanied him willingly and died peacefully is shown by the ordered arrangement of the bodies under the weight of the earth overlaid at the time of the burial. Mr. Woolley has expressed the opinion that this peaceful end was attained by the use of soporific drugs. If this were the case—and it is difficult to provide any other explanation of the facts—it would indicate medical knowledge of a kind whose limits it would be difficult to gauge when the extraordinarily high level of early Sumerian achievement in other directions is remembered.

Though they had no stone they could build great temples, beautifully decorated; they could lay out wide spreading cities; they provide what is considered by some experts to be the earliest evidence of agriculture in the growth of fine wheat; and their superb craftsmanship, many astonishing examples of which have been seen in the yearly exhibitions of objects obtained by the Joint Expedition of the University of Pennsylvania and the British Museum to Ur, could only be equalled by the most skilled of modern silver and goldsmiths.

These people and their predecessors in type had settled down in the delta land "of Sumer and Akkad", a land made by the silting up of the Tigris and Euphrates and a land so fertile that not

only does the date palm grow untended, but one that can bear two or three crops of wheat in a year. What is known as the Elamite culture had been developing here for an immensely long period—possibly several thousand years—while the primitive pastoral peoples on the desert margins had been profiting, as Professor J. L. Myres puts it, "from their raids" on "the settlements on the opposite edges of the desert, and in particular by their own knowledge and exploitation of desert herbs, many of which are fragrant or medicinal, and consequently in great request wherever their properties are known. Frankincense, myrrh, balm of Gilead, ladanum and a score of others, chiefly gums or resins exuded during the summer heat, are the stock-in-trade of the desert herbalist."

It will be noted later that all these drugs and many more are commonplaces in the medical texts from Ashurbanipal's great library at Nineveh which undoubtedly repeat traditions and practices of much earlier times. This knowledge must have been at the disposal of the highly cultured men of Ur, Kish, Ashur and Akkad and of their contemporaries or collaterals on the Indus. The earliest Sumerian script, which comes from Kish, is dated by Dr. Langdon to 4200 B.C., and is crudely pictographic. Kish was, perhaps, the most ancient of Mesopotamian cities of which record exists. It was the seat of a wealthy and cultured dynasty, ruling Sumer and Akkad before the rise of Ur. Here Dr. Langdon has found tablets bearing on medicine. A physician's seal from Lagash is shown in Plate 8.

Of hygiene we have some definite and surprisingly early evidence. In the Indus Valley and the Punjab Sir John Marshall's excavations at Mohenjo Daro and Harappa have uncovered brick-built cities, one of which, dating back to about 3500 B.C., displays hygienic ideas of an astonishingly high level. Not only are there bath-rooms in the private houses with waterproofed brick floors and house latrines [Plate 6], but a system of drainage with socketed drain pipes was provided by which the sewage was carried into street tanks, and thence removed by scavengers [Plate 5.] This civilization was at first called Indo-Sumerian because the evidence obtained showed close relations with the Sumerians of Mesopotamia. It may conceivably pre-date it.

At Kish, Dr. Langdon states, the Blundell-Field Expedition found sanitary drains as early as 3000 B.C. By 2000 B.C. we find tiled lavatories in the Sumerian courtyard and balcony houses of Ur, and each house provided with drains and efficient soak-aways.

The contrasts with Europe are heightened when we remember that at this time the Bronze Age peoples of England were living in small grass or mud-covered huts.

This is the time of Hammurabi, the great law-giver of Babylon, and we find him, in the epilogue to his Code (preserved on a diorite pillar in the Louvre), among his many boastings, recognizing the importance of the public health: "The righteous laws which Hammurabi the wise and perfect king established . . . by which he gave the land stable support and pure government . . . I expelled the enemy . . . I brought health to the land . . . I made the populace to rest in security . . . In my bosom I carried the people of the land of Sumer and Akkad."

Clearly then the ancient people of Mesopotamia lived an ordered, busy and reasonably hygienic life, from which we may deduce a common-sense knowledge of medicine and disease, although we have details only of the time of Hammurabi (c. 1950 B.C.) and later, and then, as earlier, thickly overlaid with what we regard as superstition and magic which survived from the traditions and practices of the primitive peoples described in the first chapter. We have but little reason, however, for dismissing Babylonian and Assyrian magic as pointless stupidities, for the European medieval period provides a large number of sufficiently chastening parallels. In fact, as Dr. C. H. W. Johns remarks in his *Babylonian and Assyrian Laws*, "the right thinking citizen of a modern city would probably feel more at home in ancient Babylon than in medieval Europe."

The great Code of Hammurabi is of particular interest in the history of medicine for two reasons. One is that it is a reversion to a much older Sumerian original of which fragments have been found and the other is that although the relevant clauses speak of a physician (*asu*) or healer, we find that, as Dr. Morris Jastrow has pointed out, the physician as surgeon was already to some extent "differentiated from the healer of diseases and perhaps not placed on the same level as the latter." Perhaps for this reason the Code applies the old primitive *lex talionis* to the unsuccessful operator as we see in the following clauses (the only clauses of medical interest in the Code):

> 215. If a physician operate on a man for a severe wound (or make a severe wound upon a man) with a bronze lancet and save the man's life; or if he open an abscess (in the eye) of a man with a bronze lancet and save that man's eye, he shall receive ten shekels of silver (as his fee).
>
> 216. If he be a free man, he shall receive five shekels.

PLATE V

Public Hygiene in India before the Aryans

A brick-built drain, dating before 3000 B.C., at Mohenjo-Daro, where an elaborate civilization, with Sumerian affinities, has been disclosed. This drain ran along a street and the drains from the many well-built houses on the left were connected into it. Sir John Marshall notes that every street, alley-way and passage had its own covered conduits of finely-chiselled brick laid with great precision. The whole drainage system was extremely well developed.

Sir John Marshall, Director-General of Archæology in India.

PLATE V

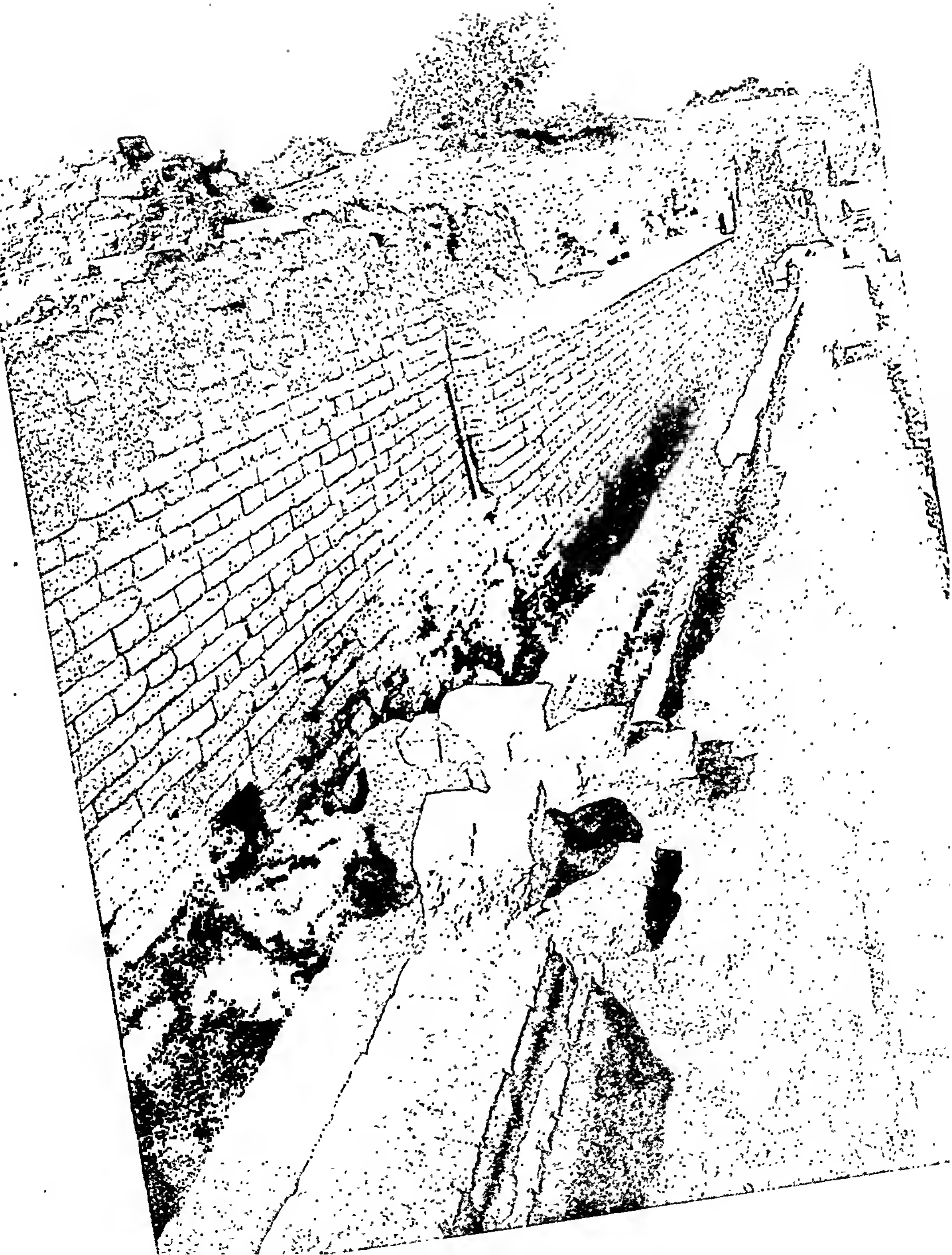


Plate VI

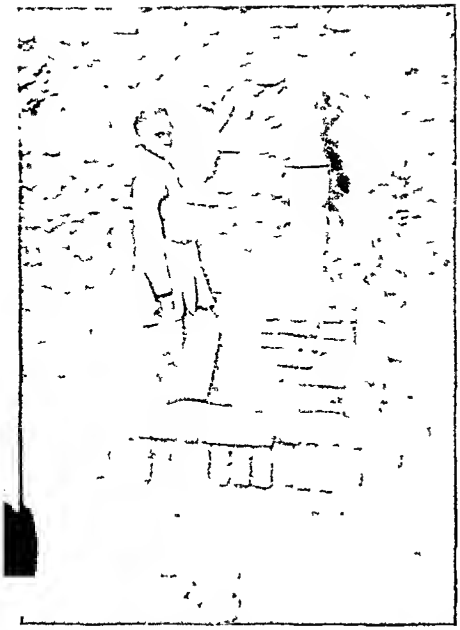


PLATE VI

Bathrooms and Drains in India and Mesopotamia between Four Thousand and Five Thousand Years Ago

The vertical pottery drain pipe from a house at Mohenjo-Daro (top left) with its elaborate brick covering, partly removed, and its efficient jointing betoken an exact hygienic knowledge such as, with the exception of Minoan Crete, we do not find again for nearly five thousand years.

The social condition, indicated by the paved bathroom and brick well from another house at Mohenjo-Daro, reached a very high level. Baths and latrines, with a public system of scavenging, were also discovered in the earliest of the three cities excavated, dating about 3300 B.C.

The perforated drain from Ur (top right) dates from about 2400 B.C. and had a partly sacrificial and partly hygienic use.

Sir John Marshall, Director-General of Archæology in India, and Mr. C. Leonard Woolley, Joint Expedition to Ur.

217. If it be a man's slave, the owner of the slave shall give two shekels of silver to the physician.

221. If a physician set a broken bone for a man or cure his diseased bowels, the patient shall give five shekels of silver to the physician.

222. If he be a free man, he shall give three shekels of silver.

223. If it be a man's slave, the owner of the slave shall give two shekels of silver to the physician.

We have here a very early example of the differentiation in payment by social status which obtains in the medical world to-day. Ten shekels would now be worth roughly £2.

It has to be noted that where the Code speaks of "a man" a person of the upper classes—a gentleman or nobleman—is indicated. The freeman is a plebeian who may own a certain amount of property or one or two slaves. The detailed regulation of the medical profession indicates that it was then highly organized.

That medical ideas and treatment, as well as those of surgery, were familiar is evident from the following paragraph in the Epilogue, the fifteenth and final of a series in which Hammurabi calls down elaborate curses on his successor "if he do not pay attention to my words . . . if he abolish the judgements I have formulated, overrule my words." The curses are called down from Bel, Shamash, Sin, Adad and the other Babylonian gods, and wind up:

> May Nin-kar-ra-ak, the daughter of Anu, who commands favours for me in E-kur, cause to come upon his members until it overcome his life, a grievous malady, an evil disease, a dangerous sore, which cannot be cured, which the physician cannot diagnose, which he cannot allay with bandages and which like the bite of death cannot be removed. May he lament the loss of his vigour!

We have now to jump an apparent interval of thirteen hundred years, but the interval is more apparent than real, for the great collection of seventh century texts we are to consider are, it appears, an inheritance. There are actually texts existing which are earlier in date. A few fragments in Semitic cuneiform characters from Boghaz Keui, the Hittite capital, date from about 1500 B.C. and are, according to Dr. Campbell Thompson, surprisingly like the seventh century texts. A number of the Assyrian texts from Ashur of the ninth to seventh centuries are also duplicates. The main collection is the work of the comparatively late reign of Ashurbanipal (668–626 B.C.) king of Assyria, the

famous Sardanapalus of the Greeks, but they represent for the larger part copies of older originals made by scribes of the king "who were sent to the temples in the south to copy the literary remains of the past that had been gathered in the course of many centuries in the archives of Babylonian temples."—(*Jastrow.*) This great collection of clay tablets, written in cuneiform, was stored in the royal library at Kouyunjik, Nineveh, and discovered in 1849. The tablets covered almost every branch of knowledge. Of the 10–12,000 fragments preserved in the British Museum 660 of medical interest have been published in *Assyrian Medical Texts* and, in part, translated elsewhere by Dr. R. Campbell Thompson.

There are also other series, one group of which while being concerned primarily with omens and their divination—an extremely important feature in the life of Babylonian and Assyrian alike—deals systematically with parts of the body and the diseases associated with them. Divination is particularly concerned with the discovery of the future—including the outcome of disease by the examination of the liver of a sacrificial animal. This examination (hepatoscopy), however, represents the first recorded observations on anatomy and so falls outside the present volume.

Others are text book lists of plants of medical value with explanations as to their use and the substances with which they may be compounded, probably drawn up for use in the temple schools in the training of "healers". Several hundred drugs are recognizable, many of which have undeniable therapeutic value and some of which survive in pharmacopœias twenty-seven centuries later. Dr. Campbell Thompson in his *Assyrian Herbal* remarks that the more these plant lists are "studied the more obvious appears to have been the great knowledge possessed by the doctors and chemists of Nineveh." In the same work Dr. Thompson has analysed and classified the drugs used in the medical texts and finds that there are about three hundred and seventy species of vegetable and mineral drugs prescribed which occur over five thousand times in the texts.

The medical texts proper down to the latest period show some association with divination and incantation, common-sense and really practical therapeutics, sometimes in connection with magic, although actually in these later texts the medical aspect is emphasized and the charms greatly reduced in number. Dr. Campbell Thompson quotes a monthly report of a state astrologer which shows that by this time (seventh century B.C.) the

offices of magician and physician are distinct, for "Bel-epush the magician is very ill; let the king command that a physician come to see him." Perhaps the magician distrusted his magic in his own person! Nevertheless, their work overlaps, as many of the prescriptions show.

Dr. Thompson considers that the texts may be divided broadly into two classes. The first include the medical texts proper which, although they frequently drop into charms which have to be recited, concern themselves mainly with the sickness and its treatment and might be taken as belonging to text books for a people without magic.

The second class consists of series of semi-magical, semi-medical rituals, "each elaborating the old triple stock-in-trade of the magician: (i) the exhibition of the knowledge of the enemy, beginning with long poetical descriptions of headache or other complaint; (ii) the knowledge of the Word of Power, i.e. the introduction of some god's name; and (iii) the drugs prescribed by the god—doubtless as efficacious as those in the first class and often the same, but thus enclosed, like Gregory's powder in jam, in a poetical spoon."

Those which are quoted in the following pages are taken from the translations by Dr. Campbell Thompson already referred to. Although the series is as yet incomplete, the portions published show it to be a work of fine scholarship. The masterly way in which the identification of drugs indicated by the cuneiform ideographs (often obscure, more or less fanciful general terms, or slurred abbreviations without direct meaning) is carried out and multitudinous elusive clues followed to track down the modern equivalents, is but partially revealed by the few examples which can be given here. Moreover most of the tablets exist as unrelated and mutilated fragments of baked clay, the joining up of which amounted to a curiously difficult form of jig-saw puzzle [Plate 7].

Dr. Morris Jastrow, writing in 1914, stated that the problem of identifying the substances used as drugs presented "the most formidable obstacle to a complete understanding of the medical texts." "In most cases," he says, "it is only if we can find a corresponding term in one of the languages cognate to Babylonian, such as Hebrew; Arabic, Syriac and Aramaic that we can solve the problem." This aspect of the matter has been referred to at some length, because, in addition to the tribute due to scholarship, it is of interest to disclose something of the methods of discovery of knowledge only now made

available seventy-five years after the discovery of the tablets themselves.

Translations published in various scientific journals between 1924 and 1931 include texts dealing with diseases of the head, diseases of the mouth and nose (including toothache and tooth troubles), the eyes, the ears, the stomach and digestive organs generally, and with ulcers, poisons, swellings or blows, the condition of the urine and also with childbirth.

The few examples of prescriptions and treatments which can be given here are chosen partly for their interest and partly for their completeness. Of the many hundreds translated the greater portion are fragmentary, due to the breaking of the clay tablets and do not lend themselves to quotation in a popular work.

A common theory of Babylonian medicine attributed disease to invisible demons entering the man's body. For "demon" read "microbe", and the theory becomes modern. The Babylonian physician, at times, called in the aid of magic to assist his often sensibly chosen medicines in routing the "demon", and to therapeutic "ritual" we have magic, incantation and charm added [see Plate 8].

Another theory made it the consequence of transgression of tabu and divine laws (as we noted with the Australian primitives, page 5). In the medical texts certain sicknesses are attributed to "the hand of Ishtar" or other god. Dr. Thompson has translated over ninety prescriptions for diseases brought about by the "hand of a ghost".

It must not be forgotten, however, that these medical tablets represent the armamentarium of the ancient Mesopotamian physicians, the knowledge and experience gained in centuries of daily practice, and they deserve not to be dismissed lightly. If some of the medicaments are foolish seeming, medicine sixteen hundred years later could equal them; if some are disgusting that is because magic declared they were necessary to disgust the "demon".

Often a genuine remedy is compounded with an unpleasant ingredient to disgust the demon. So turpentine is mixed with a green frog, sesame with doves' dung, cherry and antimony with a dried and powdered old shoe. Two closely associated examples in the section dealing with diseases of the eyes bring out these points.

> If a man's eyes are affected with dryness he shall rub an onion, drink it in beer, apply oil to his eyes.

PLATE VII

Assyrian Medical Texts as They Exist To-day

These baked clay tablets with incised cuneiform characters are specimens from the great library that Ashur-bani-pal collected at Nineveh. Their broken condition was but one of the many difficulties of proper translation. Found at Nineveh in 1849 it has only been possible to publish adequate translations of them since 1924. A, a recipe for restoring the colour of grey hair; B, a sulphur prescription for itch; C, a charm for failing eyesight. For translations of A and C, *see* page 18.

British Museum.

A

B

C

PLATE VIII

Seal of a Sumerian Physician, *c.* 3000 B.C.

The Babylonians signed their documents by rolling over the wet clay an engraved cylinder, such as this, belonging to a physician, from Lagash, and now in the Louvre. It represents Iru, a deity regarded as a form of Neɪgal, the god of pestilence and disease. The cuneiform characters are of an early type (cf. Plate VII).

From a cast in the Wellcome Historical Medical Museum.

Ancient Mesopotamian Religion and Disease

Disease was largely of demon origin and consequently priests (left, from Nineveh, eighth century B.C.) could combat it. Demonic figures were set up at the gates or buried beneath house thresholds (right) to frighten demons away. The centre figure, in bronze, was buried beneath the floor of a room, and was supposed to be able to drive away the demons of sickness.

British Museum.

As Dr. Thompson remarks, drinking a raw onion would presumably induce tears. For the same or a similar condition the same tablet states:

> Thou shalt disembowel a yellow frog, mix its gall in curd, apply to his eyes.

Although frog gall appears merely nasty, it has, apparently, real value in some eye conditions. Reptile gall diluted was used by the Egyptians as a solvent for obscuring films on the eye, in which it has been shown to have a definite effect. Throughout the East eye troubles have, apparently, been common, as they are to-day, and this fact is demonstrated by the tablets.

Over one hundred and twenty treatments in addition to charms and incantations are indicated in Dr. Thompson's translations. A few may be quoted. First we have a case of inflammation with a film over the eyes, like that seen in acute conjunctivitis, coupled with pain if the eyes are used.

> If a man's eyes are sick and full of blood, unguents only irritating (?) the blood, blood and tears coming forth from the eyes, a film closing over the pupils of his eyes, tears turning to film, to look oppressing him: thou shalt beat leaves of nigella, "gum of copper", separately thou shalt bray: thou shalt take equal parts of them, put them together; pour them into the helmet in which thou hast squeezed the tamarisk; in curd and šuniš-mineral thou shalt kneed it, and open his eyes with a finger and put it in his eyes. While his eyes contain dimness, his eyes shalt thou smear, and for nine days thou shalt do this.
>
> *Charm.* O clear eye, O double clear eye, O eye of clear sight! O darkened eye, O doubly darkened eye, O eye of darkened sight! O eye of sleepy (?) sight, O eye of . . . sight, O eye of evil sight! O failing eyes, O painful eyes, . . . eyes, like the slaughter of a sheep . . . like hay (?) thrown away, like a cup of sour wine (vinegar) thrown away . . . of these twain Nergal between them a boundary hath set . . . The charm is not . . . (?): it is the charm of Ea and Marduk . . . the charm of Nin-aha-kuddu the mistress of charm; Gula quicken the recovery and take thy fee. Recite the charm.

The charm comes at the end of the tablet and is to be used with this and three other treatments. The next is a charm from a tablet [Plate 7, C] which consists entirely of charms and incantations and obviously refers to a very common cause of eye disease—dust-laden wind.

Charm. In heaven the wind blew and brought blindness to the eye of the man: from the distant heavens the wind blew and brought blindness to the eye of the man. Unto the sick eye it brought blindness; of this man his eye is troubled, his eye is pained. The man weepeth grievously for himself.

Of this man, his sickness Ea hath espied and said " take pounded roses, perform the Charm of the Deep, and bind the eye of the man." When Ea toucheth the eye of the man with his holy hand, let the wind which hath brought woe to the eye of the man go forth.

When we turn to head troubles we have among many varieties, including scabies and itch (again common Oriental diseases for which the tablets prescribe sulphur), a considerable section dealing with the hair, two of which are quoted if only to show how old a thing is vanity:

Incantation: to preserve the hair of a woman's head.

Spin a thread . . , a PA-stone of its seven colours, *ianiba*-stone, a meteorite, stone (?) of Gutium, copper, bronze . . . thereon thou shalt thread: seven and seven knots thou shalt tie: as thou tiest (them) thou shalt recite the charm; bind them on her hair and the falling hair shall be stopped.

(*To turn grey hair black*).

. . . gall of a black ox (v. gall of a snake), gall of a scorpion, gall of a pig, punpulla . . . , suadu, thou shalt reduce, bray; these five drugs in equal parts thou shalt mix, . . . which have been buried (?) take up and together mix; in the oil of a cypress of the cemetery . . . press on his head, seven days anoint, and the grey hair will turn black. [Plate 7, A.]

The use of the sacred number seven, one of the oldest of human superstitions, is interesting here. It appears many times in the texts. Another ancient superstition which still survives in simpler form in remote country districts is that of coloured wools for amulets. Here is its parallel in Assyria:

Incantation for a Sick Eye.

Ritual for this: red wool, white wool separately thou shalt spin: seven and seven knots thou shalt tie in each: as thou tiest, thou shalt recite the charm; the thread of red wool thou shalt tie on his eye which is sick; the thread of white wool thou shalt tie on his eye which is whole, and he shall recover.

Knowing the extreme antiquity of toothache we are not unsympathetic to the Assyrian explanation though we do not fail to notice that the charm is followed by a definitely practical "ritual":

Incantation for Toothache.

Charm. After Anu made the heavens, the heavens made the earth, the earth made the rivers, the rivers made the canals, the canals made the marsh, the marsh made the worm. The worm came weeping unto Samas, came unto Ea, her tears flowing: "What wilt thou give me for my food, what wilt thou give me to destroy?" "I will give thee dried figs and apricots." "Forsooth, what are these dried figs to me, or apricots? Set me amid the teeth, and let me dwell in the gums, that I may destroy the blood of the teeth, and of the gums chew their marrow. So shall I hold the latch of the door." "Since thou hast said this, O Worm, may Ea smite thee with his mighty fist!"

Incantation for Toothache.

Ritual for this: thou shalt mix usa-beer, barley-meal and oil together, repeat the incantation over it three times, put it against his tooth (mouth).

The associated subject of bad breath is treated on sound lines as the following example shows in spite of the mutilation of the tablet:

If a man's nose and mouth hold foetor, . . . thou shalt roll up a linen pledget, bray *Salicornia*-alkali (glasswort), powdered alum, . . . , ammi, alum; sprinkle the pledget of linen with oil . . . manna green thou shalt bruise, five shekels of . . . thou shalt let him drink and . . . , . . . in oil and beer he shall drink . . . ; . . . thou shalt bray, in oil and beer he shall drink; . . . thou shalt reduce, bray, mix in oil, let him drink, and he shall recover.

Rheumatic affections appear to have been quite common. The following incantations are from a tablet devoted to the subject:

Thou shalt perform this incantation for the fumigation and washing of the swollen joint. . . .

Ritual for this: Take the roots of the caper, the roots of a thorn-bush which on a grave hath been cut out (?) sweet (?) . . . Roll it up in a band and bind it on his belly, his shins (?), and his hips.

Incantation: Turn away, turn away!

Prayer for the swollen joint.

Ritual for this: Take seven cuttings of tamarisk, char their lower ends in fire together, thread them on a scarlet thread, tie therein several knots, repeat the incantation seven times, bind it on him and he will recover.

Incantation: This is its name—Maškadu is its appellation; it hath come down from the stars of heaven; it hath seized with every

(?) poison his whole body; it hath seized neck (?), shins (?), hips, broad belly and shoulders. Marduk, who is glorious and wise, knoweth it all, too, and may the incantation which divideth all results (?) as between day and night, divide also between the sickness and his body.

Digestive troubles were serious. Tablet after tablet in the section dealing with stomach diseases begins: "If a man's stomach burns," or "If a man eats bread and drinks beer and his stomach is constricted." A somewhat heavy concoction of aromatics for heartburn is the following, a virtue of the prescription being the temporary prohibition of food:

> If a man has heartburn, and his stomach holds "fire" . . . his chest rending him, that man is suffering from the heat of the day . . . hellebore, lupins, calendula, chrysanthemum segetum, . . . gum of Andropogon (?), manna, ricinus (castor oil), lolium, . . . together thou shalt pound, in beer without a meal let him drink, and he shall recover.

Many prescriptions show that the Babylonian and Assyrian physicians were acquainted with methods of treatment in common use to-day. This, for instance, exhibits a perfectly correct opium suppository:

> If a man's belly unexpectedly is irritated, he holding wind in his anus, food and water being returned, and he being affected with constriction of the anus, and while it hurts him he cries out, and it is grievous upon him . . . thou shalt reduce lion-skin, mix with lion fat (opium): let it dry again, mix with cedar oil, make into a suppository, put it to his anus.

At one time the Egyptians were supposed to have discovered the use of the enema, but many enemas are prescribed in these tablets. Other non-drug treatments ordered in addition to those quoted above, are poultices (a large variety including linseed), bandages, plasters (including a mustard plaster for the back) compresses, salves, eye washes, unguents, liniments and aperients. As a final example we cannot do better than quote a marvellous 'cure-all' of the 'buckshot' variety which doctors more than two thousand years later were not ashamed to imitate:

> If a man's head hurts him, his mouth pricks him, his eyes trouble him, his ears sing, his throat chokes him, his neck muscles hurt him . . . his fundament, his breast, his shoulders and his loins hurt him, his fingers are cramped, his stomach is inflamed, his bowels are hot, . . . his hands, his feet and his knees ache, he

has . . . either his bowels are affected, or his kidneys are upsetting him . . . or he is sick of retention, either restriction of constipation or restriction of breath . . . or he is sick of nephritis (?) or is sick of bile, or is sick of jaundice . . . of is sick from a curse, or is sick of ulcers (?), or of rheumatism, or of the hand of a ghost . . . or is sick of the demon "Raiser of the Head for Evil" . . . To assuage his obsession . . . poppy, "stone" of poppy (opium), Artemisia, balsam, Sagapenum, . . . licorice, root of licorice, male Mandragora . . . kankadu, sumach, lidrušu, Salicornia-alkali (glasswort), . . . fennel, fennel root, ṣaṣumtu, Arnoglosson (plantain) . . . Solanum.

To conclude on this note would leave a wrong and unfair impression which must be corrected by noting the methods of treatment shown in the letters of the royal physician as translated by Mr. Leroy Waterman in *Royal Correspondence of the Assyrian Empire* (Michigan, 1930). Here we see evidence of detailed diagnosis and care in observing symptoms. Arad-Nana, the physician, writes to Esarhaddon (brother and predecessor of Ashurbanipal) about a man in whom the king is interested:

ARAD-NANA TO KING ESARHADDON.

The king my lord your servant Arad-Nana. May it be surpassingly well with the king my lord. May Ninib and Gula grant health of mind and body to the king my lord.

It is very well indeed with this unfortunate man whose eyes are diseased. I had put a dressing on them to cover his face. Yesterday toward evening the bandage which held it on I removed. I took off the dressing that was there. There was pus on it the size of the tip of the little finger. Whoever of your gods has put his hand to this case has himself surely given his orders (explicitly). It is extremely well. May the heart of the king my lord be of good cheer. In seven or eight days he will be well.

The same physician writes to the king concerning a boil or eruption. A significant point is that the king is cautioned to wash his hands thoroughly after he has put some ointment on his face. May we perhaps see in this a vague recognition of the possibility of transferring the infection from the boil on the chin elsewhere?

As to the eruption (?) concerning which the king has made inquiry . . . for the rest of the time he should take a complete rest. Let the king apply to his chin. Let the king draw pure water with which to thoroughly wash the hands of the king, my lord. Do not worry. Soon the eruption will pass away.—(*Jastrow's translation.*)

As we have already noted rheumatism was a frequent trouble. In the following letter we see that the king suffering from what appears to be a persistent attack blames the physician for the failure of his treatment. Arad-Nana admits his fault.

> To the king my lord, your servant Arad-Nana. May it be surpassingly well with the king my lord. May Ninib and Gula grant to the king my lord health of mind and body.
>
> Repeatedly the king my lord keeps saying "Wherefore do you not perceive the nature of this sickness of mine? Are you not going to accomplish its healing?" Earlier I spoke in the king's presence, "I do not understand his affliction" (?) Now I have just sealed a letter and sent it off. May they read to the king and may they explain it to the king my lord. If it is acceptable before the king my lord let a magician perform the rites pertaining thereto. This bathing of the king let them perform. Directly the fever will pass away from the king my lord. This lotion of oils should be applied to the king two or three times. The king understands it. If the king commands it in the morning let them do it. There is infection also in the pus, and the licorice which they bring before the king as they have done twice already let them rub on vigorously. I will surely come and give instructions. Directly the strength of the king will revive. Unto its full tide to the king my lord I shall bring it back. Let the king put on his throat the ointment I shall bring to the king (?) On the appointed day let the king be anointed.

The few quotations and references we have made show that, in spite of the encumbrances of incantation, divination, charms and the "demon" theory, the physicians of Babylon and Assyria, as Morris Jastrow and other authorities consider, at least reached and passed the border of the land of genuine medical science. Their very practical application of such sound methods as the texts describe of poulticing, bandaging, dressing, massaging, the prescription of diet and rest, of enemas and suppositories and the rest of their arcanum entitle them to an important share of the credit in the development of true medicine and hygiene.

So far as the influence of Mesopotamian medicine on the outside world can be gauged its most direct traces are to be seen in the medicine of the Jews, and in their social hygiene. In both, however, we may also see a reflex of Egyptian wisdom. Palestine was the meeting-place of many of the most important trade routes and, with the exception of relatively short periods under Solomon and Jeroboam in the tenth and eighth centuries B.C., the country was under the rule or vassalage of Egypt, Babylon, Assyria or other powers throughout its history.

Consequently neither Judaea nor Israel could be expected to

make independent contributions to culture and, with the shining exception of Hebrew literature, this is found to be the fact. Professor Karl Sudhoff says:

> It is no longer correct to regard the ritual hygiene of Judaism as a singular phenomenon, as in former days when it constituted the only remaining specimen of an entire cultural cycle. . . . In the midst of tides of racial intercourse flowing and ebbing from the Euphrates to the Nile we can imagine the Jewish people exposed to cultural currents from which it adopted and adapted much.

Much evidence of Babylonian and Assyrian influence is to be found in both the Old Testament and the Talmud, the latter compilation dating from the second century A.D. onwards. The Babylonian conception of the demoniac origin of disease was long held by the Jews and incantation and magic rite appear in the Talmud. Similarly, as the Assyrian regarded disease as being, at least in part, a punishment for failure to observe divine law or tabu, so in Israel disease was an expression of the wrath of Yahveh.

Two contributions to public hygiene, which were of high order, are to be credited to the Jews or at least to the Semitic peoples. The seventh day of rest, the Jewish Sabbath, is undoubtedly a great hygienic achievement. Its prototype appears in Babylonian astrology where the seventh, fourteenth, twenty-first and twenty-eighth days (with the forty-ninth) were days of ill-fortune due to the mystic powers of the number seven, whose properties all nations seem to have recognized. On those days the Babylonian neither baked nor roasted, he performed no public acts or sacrifices and he permitted no medical treatment. The great development of the Seventh Day under the Jewish regime needs no discussion here.

The second contribution is also religious in its original character. The Jewish priests, who were entirely separate from the somewhat insignificant physicians, by their code of ritual hygiene and cult cleanliness acted as hygienic police or officers of public health. Their prophylaxis or prevention of disease (despite its theologic origin) was thoroughgoing. Sudhoff and other authorities consider that prophylaxis is the greatest Semitic contribution to hygiene. The Greeks were blind to the direct transmission of disease.

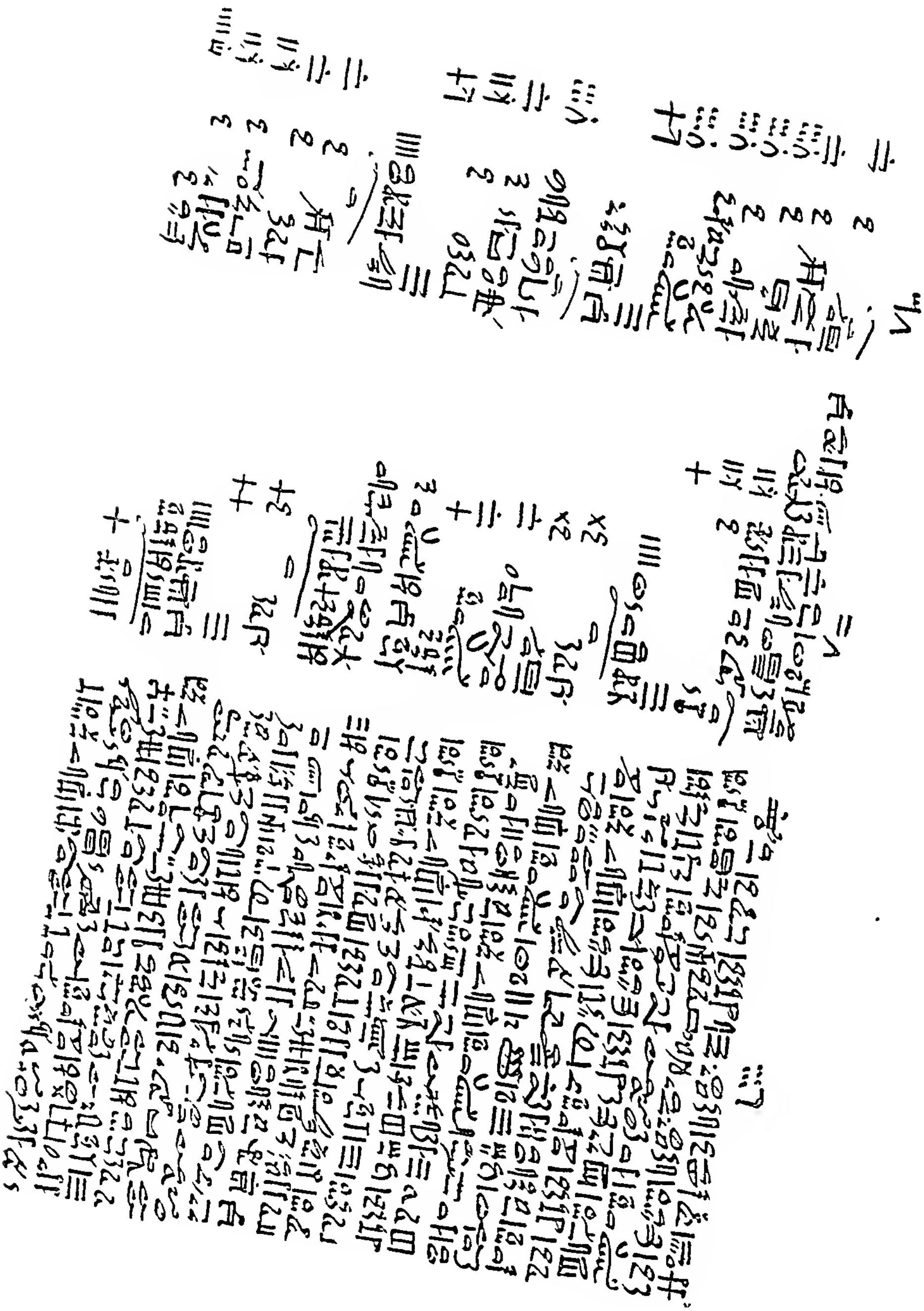
> Along the Euphrates we come early upon the conception of a chronic, rarely curable disease, characterised by cutaneous changes and capable of transmission to others. Babylonian culture readily

> drew the proper conclusion and translated knowledge into action. Those affected with this disease must be debarred from intercourse with the healthy. Whoever was defiled by *issubbu* was banished to the wilderness.—(*Sudhoff.*)

So with the ancient Hebrews. Leviticus lays down the strictest injunctions regarding unclean objects, proper foods, the hygiene of childbirth and menstruation and the prevention of contagion. Outstanding chapters are those which deal with the diagnosis and prevention of leprosy, gonorrhoea and leucorrhoea where the directions concerning segregation and disinfection—the very walls of the infected house are ordered to be scraped or the house destroyed—together with the incineration of the patient's clothes or objects he has used, are modern in their efficiency. They provided the model, which the Middle Ages adopted completely, for the treatment of lepers.

The Egyptians, whom we shall next consider, reached a definitely higher level than Babylonians or Assyrians in the true progress of medicine, particularly in the early days of the Old Kingdom. But even their progress is somewhat disappointingly limited.

PLATE X



CHAPTER III

ANCIENT EGYPT: PROMISE LIMITED BY MAGIC

In the discussion of Egyptian medicine and hygiene some discrimination in respect of time is necessary. We are dealing here with a period exceeding three thousand years in the crowded history of a great people during which empires rise and fall and, towards the end, the Western world comes to that great fruition which we know as the civilizations of Greece and Rome. External contacts by commerce and conquest are many and far-reaching and some at least of the material achievements can only be described by that much over-worked word "stupendous". Yet relative to their other great achievements the Egyptian advance in the science of medicine, considerable though it is, does not appear to be really great. Its measure and the reasons for it will appear.

We shall not attempt to add colour to our subject by giving any sketch of Egyptian civilization, for that information is readily available in many popular forms. We need merely erect a slight chronological framework. The main divisions are:

(1) The pre-Dynastic period, covering Palæolithic, Neolithic, and Chalcolithic (copper and stone using) cultures up to 3400 B.C., when

(2) the Old Kingdom begins with the First Dynasty, includes the Great Pyramid Age (Fourth Dynasty 2900—2750 B.C.), and ends in anarchy in 2430 B.C.;

(3) the Middle Kingdom (2160–1788 B.C.) includes the Eleventh and Twelfth Dynasties, and then anarchy supervenes until

(4) the Eighteenth Dynasty establishes after 1580 B.C. the New Kingdom and the First Empire. This lasts for five hundred years until, a century after the fall of Troy, the death in 1094 B.C. of the last of the Rameses, a mere nonentity, sees its final disruption.

(5) The old order is now definitely at an end, various dynasties rise and fall, brief periods of power are experienced with periods of conquest by Assyria and Persia until Alexander's conquest in 332 B.C. For the next three hundred years the Ptolemies (among whom was Cleopatra) rule and in 30 B.C. Egypt sinks to relative obscurity as a province of Rome.

To the classical world Egyptian medicine, as other branches of knowledge, stood as the archetype. For long centuries to be "learned in the wisdom of the Egyptians meant the possession of all knowledge."—(*Osler.*) Homer speaks of the high position of Egyptian medicine. This evaluation, however, has to be limited to the earlier times. In the Old and Middle Kingdoms we have medical knowledge which has claims to scientific pretensions although the appearance of dung and other substances in the therapeutics indicates the idea of driving out the demon of disease which bulked so largely in Mesopotamian medicine. In the New Kingdom, and later, magic and incantation reappear and real progress is stopped.

As in Babylon, priest and physician are identical or closely associated, and in fact Egyptian medicine never obtained complete divorce from religion. The Egyptian shared the belief of all men in the early days (up to the days of the Greeks) and of modern primitives that disease and death were not inevitable, but due to a malign influence which could use any natural or invisible agency. As Gaston Maspero, in his *Life in Ancient Egypt*, puts it:

> Whoever treats a sick person has two equally important duties to perform. He must first discover the nature of the spirit in possession and, if necessary, its name and then attack it, drive it out. . . . He can only succeed by powerful magic, so he must be an expert in reciting incantations and skilful in making amulets. He must then use medicine (drugs and diet) to contend with the disorders which the presence of the strange being has produced in the body.

In early Egypt the physician was a man of honour, and the earliest who appears in the records attained the rank of demigod. This was Imhotep, the chief minister, architect and physician of Zoser (c. 2980 B.C.), whose terraced pyramid, 190 feet high, the first built in stone, was designed by Imhotep. Perhaps the apotheosis of an actual personality, so great a reputation for wisdom in magic, medicine and architecture attached

to the name that it was never forgotten and as a god of medicine was identified by the Greeks with Asklepios [Plate 9].

A more definite personality emerges about two hundred and fifty years later in a physician to King Sahu-ra of the Fifth Dynasty, named N-enekh-Sekhmet, whose mastaba tomb at Sakkara records the royal gratitude for his healing of the king's nostril. His memorial stone carries a sculptured inscription describing him as "Pharaoh's physician" and shows him wearing the leopard skin, a garment usually reserved for priests of high rank.

The succeeding king of the same dynasty, Neferirika-ra (2730 B.C.), had a high priest named Ra-Ouer, who held the office of royal barber; two flint razors were found in his tomb, which was excavated by an expedition of the Egyptian University in 1930. The same expedition discovered another high priest's tomb, on a stele (tablet) in which were inscribed his titles and those of his father and mother. His mother was described as "Chief Physician." This is a matter of unusual interest, for she is the first woman of the Old Kingdom known to be so described, although it is known that both then and in the later Middle Kingdom women took very active and even commanding parts in the life of the community.

In the Berlin Museum there is preserved the travelling pharmacy of a queen of the Eleventh Dynasty, about 2970 B.C. It was a somewhat elaborate affair, consisting of a palm fibre case and stand, carried in a strong wooden box. The six compartments carried five alabaster vases and one serpentine vase, spoons, scoops and a faïence bowl. Root and other remains were found in the vases. It is not difficult to imagine that the queen carried and used the drugs for more than personal use. Was she, in other words, a "doctor" like the lady of the Fifth Dynasty? Mr. Warren Dawson is, however, of the opinion that the case was used for toilet purposes.

When we discussed the health of prehistoric man we were limited to the small amount of information to be obtained from fossilized bones. The Egyptians provide a much wider field for study in their consistent practice of mummification. The examination of mummies, by such authorities as Professor Elliot Smith, Sir Marc Armand Ruffer and Dr. F. Wood Jones, has produced knowledge of the greatest interest. Ruffer even evolved a technique, by means of which tissues dried three and four thousand years ago could be partially restored to the soft condition, and be examined under the microscope. In one case

he demonstrated plainly the muscle fibres and cell nuclei in sand-dried pre-dynastic remains eight thousand years old.

The practice of mummification is of direct interest to our subject for it inevitably resulted in a detailed knowledge of the human body which other peoples could not possess. In fact, as Professor Elliot Smith points out, we know from the medical papyri "that the Egyptians had knowledge of certain parts of the body and their functions which for many centuries the Greeks lacked. Moreover, by familiarizing the embalmers with the properties of many resins, balsams and other . . . substances it gave them a knowledge of their antiseptic properties which afterwards led to their being included in the pharmacopœia."

Sir Armand Ruffer's *Studies in the Palæopathology of Egypt* brings out three facts of great interest. His microscopic examinations proved that, young as well as old, the Egyptians suffered as much as we do from hardening of the arteries, generally supposed to be a product of our busy, rushing modern life; the arterial lesions are identical with those found in twentieth-century patients. He can offer no reason for its prevalence three thousand and more years ago. Tobacco, alcohol, heavy meat diet, wear and tear—all the modern explanations—are examined and dismissed.

A second fact is the extraordinarily widespread evidence of the diseases which we group under the heading "arthritis." Spondylitis deformans (thickening and deformation of the spine, a condition already noted in prehistoric remains) was extremely common and often crippling. So also was arthritis deformans. Professor Elliot Smith declares that "arthritis is par excellence *the* bone disease of the ancient Egyptians and Nubian. . . . The pre-Dynastic Nubian scarcely ever grew to adult life without experiencing some of its effects." Sir Armand Ruffer found evidences of it in human remains in Upper and Lower Egypt from pre-dynastic times to the third century A.D., a period of at least eight thousand years during which arthritic disease was both chronic and common. There is even a case of it in a Miocene Period skeleton, going back some 900,000 years!

Why this painful and crippling disease should have spread so serious a blight on Egyptian health remains apparently a mystery. Climatic conditions, says Sir Armand Ruffer, can have no relation to it. Under-nutrition is also not an adequate reason, although there is evidence to show that during long

periods great masses of the people were ill-fed and ill-housed. The condition of the fellahin to-day probably reflects something of that of their class in ancient times.

Modern medicine does not follow the older theories directly associating arthritic disease with damp and unhygienic conditions. Arthritis (joint inflammation) is regarded as due to infection, external or internal; osteo-arthritis, while not perfectly clear, is regarded as a degenerative change in joints subject to strain or injury and most common in those exposed to a rough life. May we, perhaps, find here a partial clue to the mystery, remembering that from the earliest to the latest times the glory of Egypt was its mighty monuments whose erection was the labour, mercilessly forced, of myriads of slaves of every generation? For instance, to haul an obelisk a short distance from its quarry five thousand men were employed under the lash of overseers. Diodorus states that 360,000 men were employed for twenty years in building a pyramid. Such brutal labours must have been conducive to every variety of strain and injury, particularly, under the stress of hauling, to the spine.

The third branch of Sir Armand Ruffer's studies which we are able to discuss here was an elaborate investigation of the condition of the teeth in Egyptian remains of all periods.

In modern times arthritic troubles are often associated with dental decay but, as Sudhoff puts it:

> Upon inspecting the many early Egyptian and Nubian crania we are astounded at the perfect preservation of the teeth, although the extensive abrasion of the masticatory surfaces is rather startling, suggesting simple, suitable fare, but mainly of vegetable character rich in cellulose and with a generous adulteration of sand particles.

This excessive wear resulted in exposing the pulp cavities of the teeth so that alveolar abscesses without dental caries are commonly found. Later, with softer and more luxurious feeding, dental decay appears. Tartar formation, caries and alveolar abscesses were found in some five hundred skeletons of aristocrats of the Third and Fourth Dynasties excavated at the Gizeh pyramids in proportions at least as common as those found in modern Europe. "And at every subsequent period of Egyptian history one finds the same thing—the wide prevalence of every form of dental disease among the wealthy of luxurious diet, and the relative immunity among the poorer people. . . . There is in no case the slightest suggestion that any operative

measures were adopted to cope with dental trouble and, in spite of frequent statements to the contrary, tooth-stopping was never practised in ancient Egypt."—(*Elliot Smith.*)

Sir Armand Ruffer remarks that "it is impossible to believe that Amenhotep III would have endured the agony which he must have gone through if the court dentist had known how to pull out a tooth." He also finds no evidence that the tooth brush was in common use in Egypt.

Most of the diseases with which we moderns are acquainted existed in ancient Egypt, although the existence of rickets or of syphilis is unproved. Tuberculosis was not unknown, including Pott's disease (which we have already found in Neolithic Europe, see page 4).

Further discussion of Egyptian disease is not necessary here. We want to see what steps the Egyptian physician took to combat and prevent disease and what his mental attitude was to health and disease. Ideas which have been put forward by various authorities on these points are somewhat contradictory. It is not a case of letting the Egyptian, as represented by his documents, speak for himself. The few medical documents that survive are fragmentary, corrupt and written in a dead language full of technical terms that cannot be directly translated. Each age has its own technical words for which later ages have no exact equivalents. Much therefore depends upon interpretation. Professor Breasted, stating that a careful study of the medical papyri of Egypt as a group and the preparation of a sound glossary of their medical terms is necessary to a proper evaluation of Egyptian medicine, refers to the "so-called translations of the Papyrus Ebers . . . with misunderstandings on every page which make them ludicrous. . . . Much popular writing based on such translations has professed to give us some account of Egyptian medicine."

Mr. Warren Dawson, in his *Magician and Leech*, strongly reinforces this view when he says "the student of ancient Assyrian medicine is in a far better position to investigate his subject [thanks to the painstaking labours of Dr. Campbell Thompson referred to in Chapter II] than the student of Egyptian medicine, for in the latter case a great part of this preliminary work remains to be done." He is of opinion that, apart from Professor Breasted's translation of the more coherent and intelligible Edwin Smith surgical text, no translation exists on which the slightest reliance can be placed.

This is the more unfortunate in that there is a general impression among the lay public that Egyptian medicine is well understood and can be readily dismissed as a mere mixture of magic and incantation leavened with a certain number of effective drugs. It is still more unfortunate because the Egyptian medical papyri are the oldest medical books existing. The Assyrian tablets which we have only date from the seventh century B.C., while the papyri are of the sixteenth and seventeenth centuries, B.C. Both groups represent and perpetuate knowledge, written and traditional, far older than themselves, but the priority of either the Egyptian or Mesopotamian medical schools must remain an open question in the absence of early Sumerian texts which may be assumed to have existed. Older hieroglyphic or cuneiform texts than those we have might at any time be discovered.

The Egyptian medical texts are written in hieratic script on papyrus. Papyrus was obtained from a tall weed now extinct in Egypt, the fibres of which, laid side by side, make a kind of paper. Hieratic (i.e. priestly, since clerical work was at first mainly confined to the priest caste) was a simplified form of hieroglyphic (the original picture or ideographic writing of the Egyptians) used as early as the Old Kingdom for rapid writing on papyrus.

The four principal medical papyri in order of date are: the Edwin Smith (about 1600 B.C.), the Ebers (about 1500 B.C.), the Hearst (1400–1500 B.C.) and the Berlin No. 3,038 (1290–1230 B.C.). Each contains material that is common to all—although the Edwin Smith has one side that is entirely fresh and of great importance for its surgical interest—and the subject matter of all is at least many centuries older than the documents.

The most famous and the longest is the Ebers, discovered with the Edwin Smith as long ago as 1862. It was the first to be published, and was translated in part some forty years ago. The value of the translation has been already commented upon. As Mr. Warren Dawson describes the papyrus, it is a "miscellaneous collection of extracts and jottings collected from at least forty different sources" and "consisting mainly of a large collection of prescriptions for a number of named ailments, specifying the names of the drugs, the quantities of each, and the method of administration. A few sections deal with diagnosis and symptoms" [Plate 10].

Its mixture of magic and incantation with medicine include extracts from books which were probably written in the Twelfth

and Thirteenth Dynasties though their subject matter is possibly many centuries older.

Egyptian magic is similar in principle and, to some extent in application, to that of the Assyrians which we have already discussed, and we shall therefore content ourselves with noting instances in which the papyri show advance towards scientific method. Since the older translations are unreliable we turn to the work of Mr. Warren Dawson and Professor J. H. Breasted, two modern Egyptologists, who have made some study of the texts. In the 875 recipes of the Ebers Papyrus there are only forty-seven diagnosed cases. Of these the most interesting are found in a section entitled "Directions for Illness of the Stomach," where symptoms, diagnosis and treatment are given for each of twenty cases. As Mr. Dawson justly observes in his *Magician and Leech*, "this collection of cases marks a great advance in real scientific observation and treatment." Each case begins "If you examine a man who suffers in the stomach" with a description of the symptoms, after which is the formula "You say concerning it: 'It is so and so'" (diagnosis). The treatment, with a prescription for drugs then follow. Unfortunately even this text is so corrupt (partly through being copied from older texts by scribes ignorant of their subject) that a direct translation which would be intelligible to a reader unacquainted with ancient Egyptian has been found impossible. The following rendering of one passage by M. Maspero gives a general idea of its nature:

> If you have to deal with a patient (attacked) by an obstruction . . . if he feels heaviness after eating, if his stomach is full of wind, if his heart troubles him while walking as it does in the case of a patient suffering from anal fissure—examine him lying on his back, and if you find his stomach warm and some obstruction in the intestine say "something is wrong with the liver." Then give him the secret remedy of herbs which the doctor must mix himself.
>
> Take the pulp of walnuts, and dates, mix, soak in water, make the patient drink it four mornings consecutively, to relieve and empty the stomach.
>
> If after having done this you find the two hypochondria, that on the right warm, that on the left fresh (clear) say (about it): "The internal juices are fighting the evil which is destroying them!"
>
> If on examining him a second time you find all the stomach clear, say "His liver is cured, it is cleansed, he has taken the remedy well."

The less scientific portions of the document where incantation and drug and treatment without diagnosis are mingled, include prescriptions for the bowels, intestinal worms, preven-

PLATE XI

Temple of Isis at Philae, a Medical Centre

Besides the service of the gods many of the Egyptian temples were devoted to medical learning and the healing of the sick under the care of priest-physicians. As in the Asklepian temples of the Greeks, votive offeiings and memorial tablets were deposited in the shrines. The photograph shows the temple of Isis at Philae before it was inundated.

Photo, Beato.

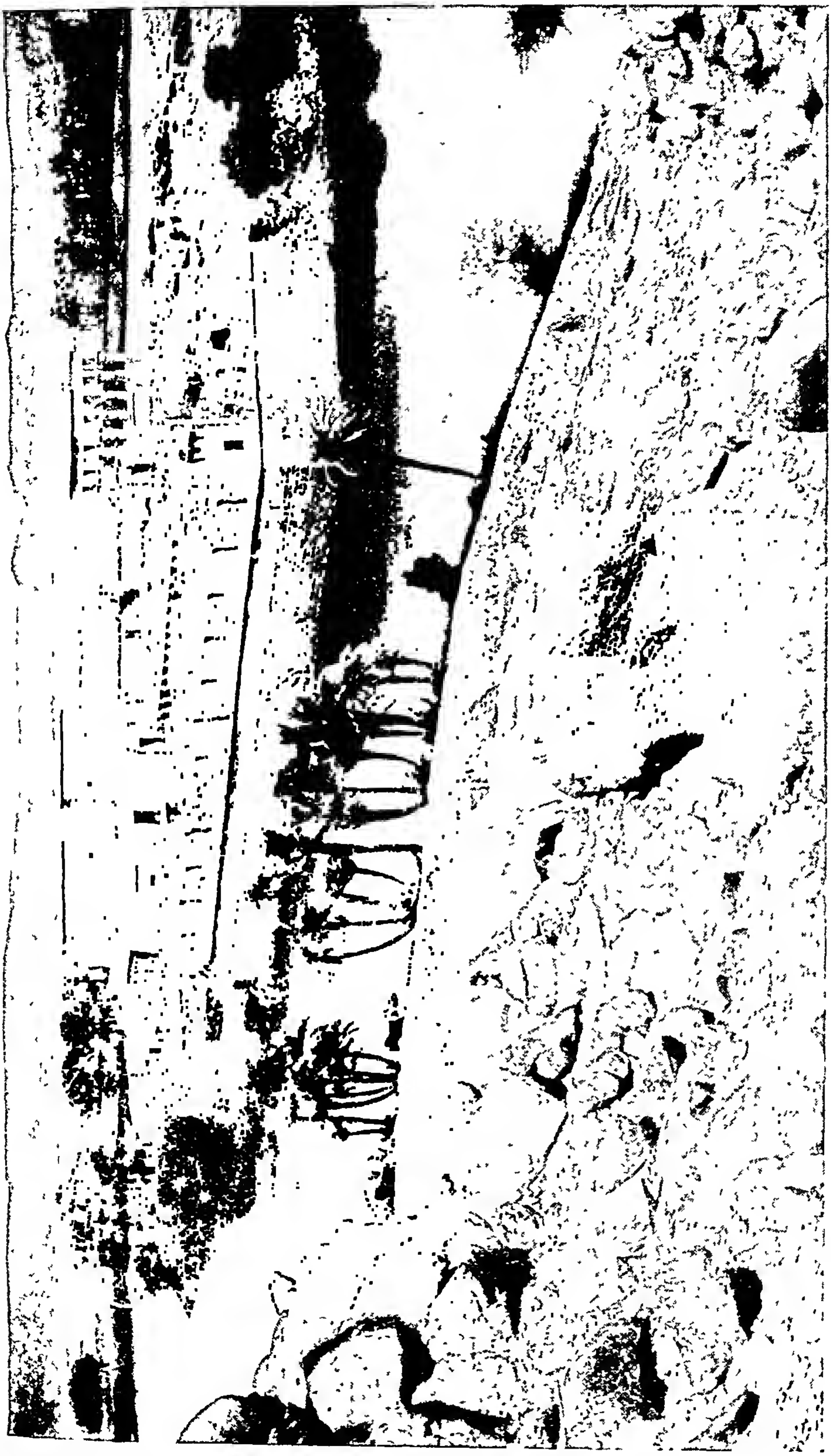


PLATE XII

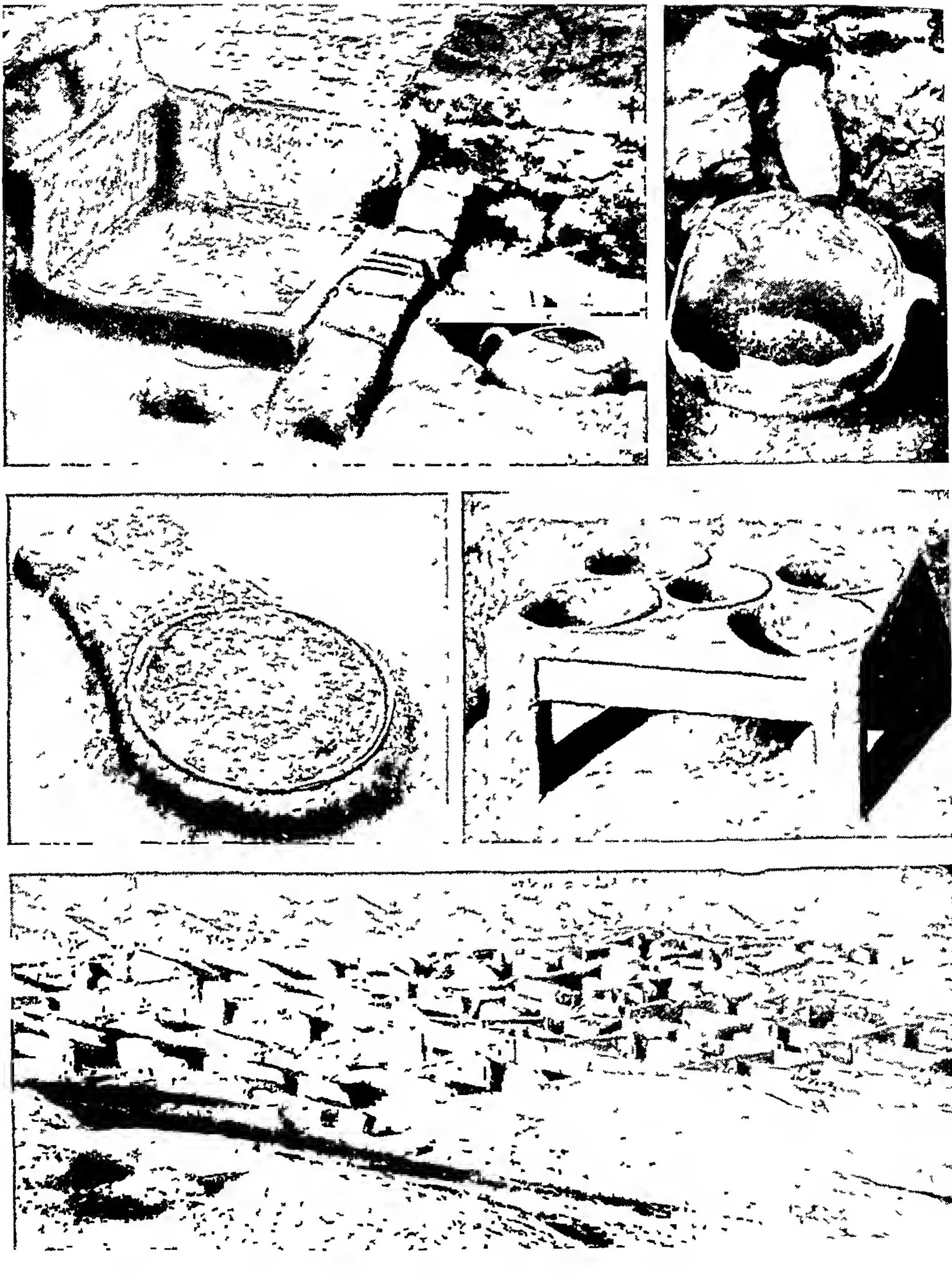


PLATE XII

Hygiene in an Egyptian Town, 3,300 Years Ago

The town of Akhetaton, built by the heretic king Akhnaton of the 18th Dynasty (predecessor of the much-advertised Tutankhamen), was excavated by Professor T. E. Peet and Mr. C. L. Woolley. The private houses were well-ordered: in that of the nobleman Nekht were found (top) a bathroom, with sump and a drain, and (centre) a brazier stand, and a stand for water jars, for drinking and washing. The workmen's village, near the quarries, was crowded within a strong wall, each house containing four 1ooms—but no signs of hygienic convenience. Cleanliness was, apparently, the concern of noble, priest and official only.

By permission of the Egypt Exploration Society.

tion of vomiting, securing appetite and digestion, diseases of the eyes (a matter of even greater importance in Egypt than in Mesopotamia where eye troubles are common enough as we noted in page 17), lungs, liver, head and hair, mouth, teeth, tongue, throat and ear. Stiffness of the muscles and joints (obviously the rheumatoid complaints to whose widespread occurrence attention was drawn above) are dealt with in a long series of prescriptions.

The Egyptian pharmacopœia was an elaborate one and the art of pharmacy highly developed. Dr. Singer notes that "some thirty per cent of the crude vegetable drugs in the modern official pharmacopœia were known in antiquity." These include, of the hundreds of ingredients mentioned in the papyri, aloes caraway, castor oil, coriander, dill, fennel, juniper, mint, myrrh and turpentine. One particularly interesting example is hartshorn, whose earliest use appears in Ebers where several prescriptions indicate powdered or burnt antlers or horns of stag, which as "spirits of hartshorn" (i.e. aqueous solution of ammonia) still appears in modern pharmacy. Hartshorn also appears in the Assyrian medical texts.

A section of the Ebers papyrus dealing with castor oil (which we have already seen in an Assyrian prescription, page 20) is of interest not merely as showing the use of a very familiar drug, but because, as Mr. Dâwson points out, the passage which discusses it ranks as the earliest known fragment of a herbal. It shows considerable acquaintance with the virtues of the castor-oil plant (*Ricinus*). Mr. Dawson's rendering of this passage, which he describes as difficult and corrupt, is this:

> *List of the virtues of Ricinus;* it was found in an ancient book concerning the things beneficial to mankind.
>
> If its rind be brayed in water and applied to a head that suffers, it will be cured immediately as if it had never been affected.
>
> If a few of its seeds be chewed with beer by a person who is constipated, it will expel the fæces from the body of that person.
>
> The hair of woman will be made to grow by means of its seed. Bray, mix and apply with grease. Let the woman anoint her head with it.
>
> Its oil is made from its seed. For anointing sores that emit a foul discharge. . . . Anoint very early in the morning in order to drive the (sores) away. A true remedy, proved millions of times.

Other prescriptions in the Ebers, Hearst and Berlin papyri employ it for purging, for head diseases and in fumigations and external applications.

One or two other examples which have been deciphered by Mr. Dawson from Ebers may be given. Intestinal troubles in addition to constipation were common. Here is an application for colic:

> Another for expelling illness from the side of the abdomen. *Efai* plant, 1; dates, 1; cook in fat. Bandage therewith.

A number of vermifuges appear, the rind of pomegranates pounded in water being frequently ordered, a use which survived for many centuries in East and West.

For the rheumatoid complaints referred to above the prescriptions bring out clearly the mixture of magic and reason, the rational element consisting of an ointment or emollient with an animal fat basis, and the magical of the addition of fats rare and difficult to obtain. The physician thereby added to the treatment that element of faith which has always been found effective. A characteristic remedy is this:

> Another for easing stiffness in any part of a man. Natron, 1; grease, the second day, 1; hippopotamus fat, 1; crocodile fat, 1; fat of *adu*-fish, 1; fat of silurus fish, 1; incense, 1; sweet frankincense, 1; honey, 1. Warm, bandage therewith.

If we are inclined to smile as members of a less credulous civilization at such foolish treatment let us consider the therapeutic use of the mouse. Among the many animal remedies found in the papyri we find the eating of a skinned mouse prescribed for an infantile complaint. Professor Elliot Smith speaks of the remains of mice which were discovered in the alimentary canal of child skeletons found in a pre-dynastic cemetery which dates back to about 4000 B.C. Evidently they were given in despair to children at the point of death. We smile; but the amusement changes to amazement when we learn that not only is there evidence for mouse medicine throughout classical and medieval times but that it has existed in the twentieth century. Mr. Dawson made personal acquaintance in 1925, and afterwards, of persons who, in their childhood, had swallowed skinned mice for the cure of whooping cough and other child ailments.

On the whole, however, Egyptian medicine is worthy of more respect than such items suggest, especially in respect to methods of treatment and application of remedies. The directions given in the papyri prescriptions as to the administration of the drugs are entirely modern in character. The quantities are minutely

specified in the prescriptions, the patient is instructed how often to take the medicine, whether at night or morning, before or after food and for how many days (not more than four in acute cases, when the treatment had to be changed).

Medicine is administered in milk, water, honey, wine or beer. There is an impressively modern array of treatments and remedies in Ebers and other papyri, including bandages, poultices, plasters, pills, pastilles, suppositories, enemata, gargles, inhalations, fumigations, snuffs, salves, ointments and emollients of many kinds.

The Edwin Smith papyrus which has only recently been studied and translated by Professor J. H. Breasted, although it was discovered at the same time as the Ebers papyrus, is of greater interest than all the other papyri. Its chief authority considers it "the torso of a great lost medical book on surgery and external medicine." Its contents are mainly surgical, consisting of forty-seven cases which begin with the top of the head and proceed systematically downward breaking off suddenly in the forty-eighth case dealing with the spine. The cases are arranged in a standard order thus:

> *Title:* " Instructions concerning a wound in the ear.
>
> *Examination:* If thou examinest a man having a wound in his ear cutting through its flesh, the injury being in the lower part of his ear, and confined to the flesh, thou shouldest draw it together for him with stitching behind the hollow of his ear.
>
> *Diagnosis:* Thou shouldest say concerning him: a sufferer having a wound in his ear.
>
> *Verdict*, one of three: (1) " It is an ailment I will treat "; or (2) " It is an ailment I will contend with "; or (3) " An ailment I will not treat."

More scientific in his outlook than the all-powerful magician, the physician-surgeon, saw clearly the limits of his powers; as Dr. Marett puts it, his is a department in which the peculiar effects of the faith cure are never likely to be prominent at any stage of human progress. In the first case he is confident of the outcome, in the second he recognizes serious trouble and in the third he abandons hope. Only thirteen of the forty-seven cases described receive the last verdict.

The medical aspects of this papyrus are few, but Professor Breasted's elucidations of them may be summarized. Wounds and bruises are healed by the application of fresh meat (*cf.* the

modern housewife's beefsteak for a black eye) followed after the first day by honey ointment and an astringent herb. Surely a sound enough treatment—and it is three thousand five hundred years old in this text.

The physician's attitude was largely one of co-operation with nature. Repeatedly the writer of this text, the ancient authority, directs the practitioner to do nothing but put the patient on normal diet and await results. The words of this instruction are curious. The expression is, "put the patient on his fingers" and even the Egyptian copyist of the seventeenth century B.C. found this expression strange, so he adds the comment: "it means—to put him on his accustomed food without giving him medical treatment." The idiom is probably connected with the notion of eating with the fingers.

The other two papyri to which reference has been made, the Hearst and the Berlin, have little further material of interest to our study, being similar in character to the Ebers papyrus. The Hearst papyrus came from a ruined house in a small provincial town and Dr. Offord considers that it "was probably an inexpensive copy of the then common medical treatise possessed by a country doctor for his daily use."

If we could end on the note struck by the Edwin Smith papyrus and infer a gradual progress in medical science, or even a maintenance of the standard reached, Egyptian medicine would stand as high or even higher in our estimation as it did in that of the ancient world. Unhappily we cannot. In the New Kingdom and the Empire, the days of the Thothmes and Amenhoteps (including the short reign of the insignificant Tutankhamen) of the Eighteenth Dynasty, and the two Rameses of the Nineteenth, magic and incantation re-appear. As Professor T. E. Peet remarks: "On medicine as on religion magic laid its devastating touch. Medical science was already old in the Middle Kingdom and yet it made no advance from that time onward. Magic had stopped its growth." We have seen above that all the indications are that the best and most scientific portions of the medical papyri now in existence are copied from much more ancient texts.

If magic stopped the growth of medicine religion may claim to have given medicine better service. The priest-physicians not only kept alight and handed on from century to century the lamp of medical learning but devoted their temples to the service of the sick as well as of the gods to whom they were dedicated [Plate 11]. Here we may possibly see partial anticipations

of those temples of healing which under the Greeks nearly became effective hospitals. Dr. Jayne, in his *Healing Gods of Ancient Civilizations*, says:

> There were many healing temples in the Valley, but eventually all the great medical centres were located at the chief capitals along the Nile, and large numbers of people travelling . . . and making annual pilgrimages, sought the curative influences of their favourite deities. . . . These healing shrines were depositories of medical lore. . . . On the walls of the sanctuaries were inscriptions and votive tablets in commemoration of miraculous cures and round about, in the precincts, steles and statues erected by former patients in grateful recognition of cures effected by the divinity. Here priests and lay brethren who were to practise healing pursued their studies and took their oath.

Finally we must give some consideration to the hygiene practised in Egypt which in the eyes of the classical world, if Herodotus reports accurately, ranked even higher than their therapeutics. One suspects that, excellent as it probably was, Egyptian hygiene concerned itself principally with king, priest and noble. In the great township of Akhetaton at El Amarna, built by the heretic king Akhnaton about 1370 B.C., remains of bathrooms and drainage systems are found in the fine houses of vizier, noble and priest, but none in the close-packed dwellings of the workmen at the quarries [Plate 12]. Similarly in the earlier Middle Kingdom (Twelfth Dynasty) town of Illahun, the lay-out of the mansions is spacious but the workmen's houses are crowded behind a thick wall.

Certainly hygiene reached a high stage of development which could not have been without some influence on the life of the people. Divine ordinations regulated public and individual cleanliness in dwelling and person. Many temple inscriptions promised health and long life to the clean and temperate. The priests set the standard, with their baths every six hours, their body shaving at three-day intervals and their spotless white clothing. On the public side they provided a ritual form of meat inspection before and after slaughter which, while intended to preserve the purity of the sacrifice, assisted public health, since rejected meat would not be eaten. There was some recognition of the value of prevention of disease for, deriving most disease from dietary error, they observed a form of prophylaxis, at least in Herodotus' time, in the custom of administering emetics and enemata for three consecutive days each month.

But the tale of hygiene and health, as of genuine science in medicine, is not a long one. If their system of drug treatment was comprehensive and, in effect, sensible and soundly based we have but little direct evidence of interest on the general nature of disease or of the pursuit of knowledge for its own sake, for the advancement of humanity and the extension of the boundaries of experience which we know as science. For that we have to wait for the blossoming of the mind of the eager, ever-curious Greeks. The Egyptian saw only the concrete, the specific case before him, the thing of obvious and immediate usefulness. We may at least, however, give both Egyptian and Assyrian credit for having established the foundations on which the Greeks built. Plato is stated to have remarked that "Whatever we receive from the barbarians we improve and perfect." Dr. Jayne considers that "The Egyptians were a mine from which the ancients borrowed freely, copying and adapting, too often without credit to the originators."

So we turn finally from the East to the West, and our next chapter begins with the discussion of a civilization which runs parallel in time with the whole of the long-lived Egyptian culture we have been considering, and having at all points some relations with it. This Minoan civilization is, in fact, to be regarded as containing the beginnings of Greek, and therefore of European civilization.

CHAPTER IV

BEGINNINGS OF WESTERN SCIENCE: CRETAN HYGIENE AND GREEK MEDICAL SCHOOLS

OUR CHIEF interest and purpose in this work is to trace the development of ideas in, and the progress of, those branches of knowledge that affect health. In the preceding chapters we have, in addition, given a sketch in outline of the sum of medical knowledge possessed and applied by the primitive and ancient world up to the coming of the Greeks. That historical outline has been given partly for its own interest, since much of it is taken from the work of recent scholarship, and is not easily available to the lay reader, and partly to controvert the notion still too often expressed that before the Greeks there was nothing, no science in medicine, no commonsense or sound practice in hygiene, nothing but meaningless magic and silly superstition. The reasons for this notion need not detain us. It suffices to lay emphasis on the fact that marvellously clear sighted as were the greatest of the Greeks, great as our debt is to them in the whole structure of medical science, yet even they built on foundations laid not unskilfully by men who went before them, unnamed though most of them be.

We turn then from East to West.

The great epics of Greek legend are found by excavator and archæologist to have their historic basis and environment in the perished civilizations of Minoans, Trojans and Mycenæans of which the greatest and longest lived was the Minoan, a culture which lasted over two thousand two hundred years—as long in fact as all European culture from the rise of Athens to our own day—and reached a height in art, science and social life which placed it above all others until the coming of the glory of Ionia and Attica.

Broadly the era covered by the three Periods of Minoan culture in Crete and the Ægean Sea—Early, Middle and Late—extends from about 3400 B.C., the age of the pyramid builders of Egypt, to about 1200 B.C., when the advance of the Achæans

in the Ægean completed in Crete the destruction begun by earlier earthquake calamities, when Troy fell and Egypt under the Twentieth Dynasty was definitely on the down grade.

If it were possible to interpret the Minoan texts we should doubtless find matter of medical interest which would throw light on later Greek developments. Although we have plenty of evidence of Minoan intercourse with Egypt (practically the whole system of Minoan dating depends on Egyptian contacts) there is none of culture debts to Egypt; rather does it appear that Egypt borrowed from Crete. What, therefore, of culture the Greeks derived from Crete, either directly, or indirectly through Mycenæ, would have little tinge of Egypt.

Until the Cretan alphabet gives up its key we must be content with material evidence, mainly hygienic, of interest to our inquiry. In the Early Period we find nothing, but in the Middle Minoan Period whence dates the first great palace of Knossos we find an advanced architecture coupled with the initiation of a drainage system excelling any practised in the ancient world, except by the Romans. In the Late Period (from 1600—1200 B.C.) the great temple-palace of Knossos displays its final wonders. Its labyrinthine structure, its great pillared halls, its stairways, its sanitary contrivances, give an astonishing picture of the wealth, power and scientific progress of this early island state which ruled the whole Ægean area, including its coast lands.

The excavations of Sir Arthur Evans at Knossos, described in his great work *The Palace of Minos*, have brought to light several interesting examples of Minoan sanitation of which the following may be quoted.

The palace of the first Middle Period (M.M. I) was supplied with water by means of pipes which were, it is said, better adapted for preventing the accumulation of sediment than the water pipes of modern cities [Plate 14].

Of the second Period (M.M. II) Sir Arthur Evans says:

> It is not too much to say that comfort and luxury were studied with a greater completeness than ever before in the history of the world. Thus the palace had a system of sanitation superior to that of any other ancient civilisation; superior indeed to that of any medieval city.

In his 1929-30 excavations Sir Arthur discovered a series of immense stone-lined pits (*koloura*) which had been constructed in the M.M. II Period (over ruins of houses of the previous Period) for the sole purpose of disposing of the city's rubbish [Plate 13].

PLATE XIII

City Sanitation in Minoan Crete, c. 1900 B.C.

In the wonderful city of Knossos, with its great Palace of Minos, excavated and restored by Sir Arthur Evans, circular walled pits of large size, called *kouloura*, were constructed for the sanitary disposal of rubbish from the Palace area. Earth was apparently used in layers to prevent effluvia, and a certain amount of surface water was drained into them. These most effective public rubbish dumps, arranged in line, were built in the M.M. II Period (1900-1750 B.C.) on the ruins of houses of the previous Period.

Courtesy of Sir Arthur Evans.

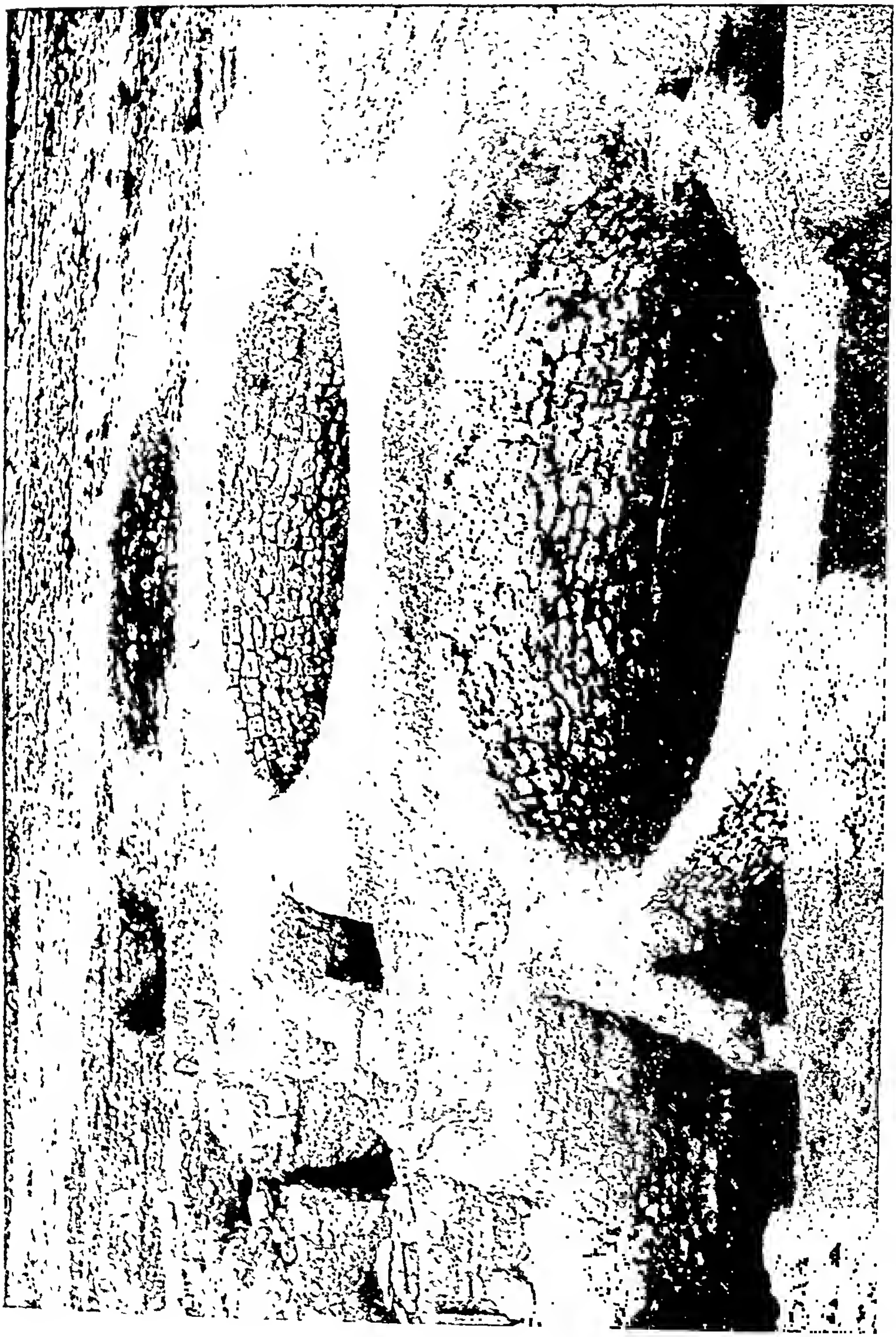
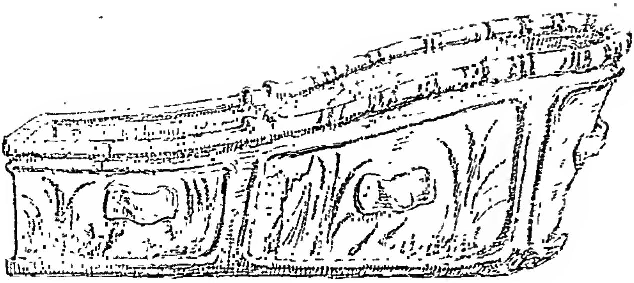


Plate XIV



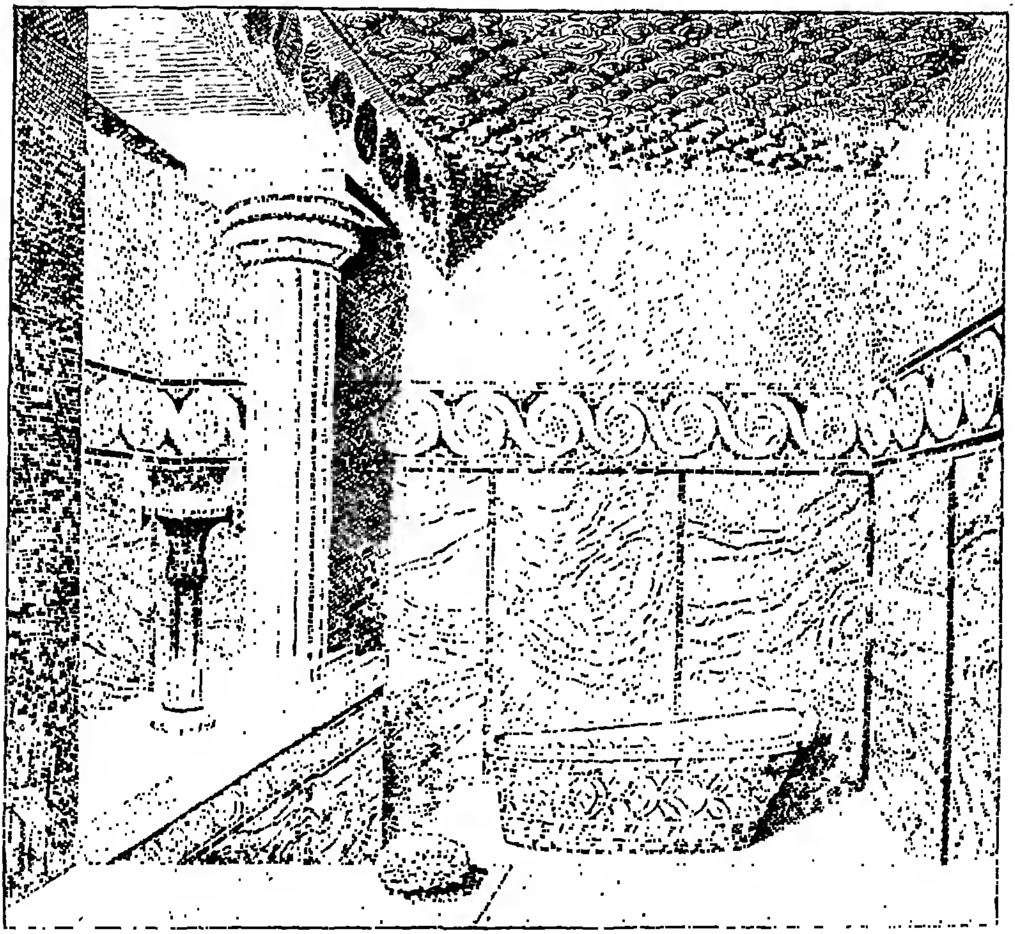


PLATE XIV

Personal Hygiene in the Minoan Palace of Knossos

In the Queen's apartment an ornate bathroom has recently been found and restored by Sir Arthur Evans; it dated from the Late Minoan II period (c. 1400 B.C.). Its painted terra-cotta hip bath was filled and emptied by hand. An earlier type of bath (of M.M. III period) is shown above. A remarkable water main, even earlier (M.M. I, about 2160 B.C.), was made of terra-cotta. As seen, it had collars and top ridges, and each section was of tapering form that "gave a shooting motion to the water and prevented sediment." "These pipes," says Sir Arthur Evans, "show an advance on nearly all modern systems of earthenware pipes" with parallel sections. As related in page 225 efficient earthenware pipes were only re-invented in England in the late nineteenth century—4,000 years later.

From Evans, "The Palace of Minos", Macmillan & Co., Ltd.

Throughout the Middle and Late Periods all the bigger houses of Minoan Crete, whether at Knossos or the other settlements on the island, were fitted with bathrooms with clay pottery hip baths of curiously modern shape. Indications have even been found of a hot water supply. In one large house, probably belonging to a court official, near the palace a lustral (ritual) area of the last Middle Period (M.M. III) was in the next (L.M. I) filled in—

> and its conversion into what looks like that of an ordinary bathroom resembling that of the Domestic Quarter, is a significant circumstance. It looks as if the ordinary conveniences of domestic life were beginning to outweigh religious ceremonial.—(*Evans.*)

The queen's bathroom in the L.M. II palace, as restored by Sir Arthur Evans, is a marvel of spaciousness which would do credit to any modern mansion [Plate 14].

Cretan sanitation of the last two periods (L.M. II-III) may be regarded as a model. We have a measure of the Minoan achievement when we consider that the rest of Europe during this time (1450–1200 B.C.) was still inhabited by nomadic and migrating barbarian peoples of the Bronze Age, and that even in Egypt iron, the principal material element in all our modern civilization (for we are now in the Iron Age), did not come into use until the end of this period. Sanitation is one of the last teachings to reach even civilized peoples but the Minoans possessed it over three thousand years ago.

On the river side of the great palace was a sewage system designed both as a means of disposing of surface water and, by connecting the rain conduits with the water closets, etc., as a method of obtaining water-borne sewage. Large cut stone shafts, cement lined, descended vertically from the upper stories of the "domestic quarter" and opened into large stone conduits which brought the rain water to the drains, ventilated the sewers and gave access for cleansing. Their very water closets resembled the modern wash-out type, i.e. they always had water in the pan. Apparently they were provided with wooden seats.

The excellence of their sanitation makes keener the regret that the long failure to solve the difficult puzzle of their script renders impossible any investigation of their medical knowledge. At any rate it is fairly clear that here was the main source of the hygienic ideas of the Greeks.

We learn nothing fresh of importance from the Mycenæan remains of the mainland so that jumping a period of nearly

six hundred years we turn to the Greeks of the seventh–sixth century B.C.

Our main underlying purpose here is to bring out the fact that we are now dealing with people—thinkers, scientists, practitioners—whom we may meet on our own ground, whose ideas and observations need no translation for our easy comprehension. We do not see those ideas mistily as though a veil as we do the definitely strange and foreign thought of Babylonian and Egyptian.

In Greek thought everything is clear cut, its outlines hard and sharp with no mystification of idea-arresting magic, no prohibition of priest-ridden religion. There is, in their religion, no dominance of a priestly hierarchy. Science is saved from dogmatism. In the earlier peoples it is a matter for surprise that with all their handicaps they achieved so much so many thousands of years ago. But with the Greeks it seems natural and obvious that we should find them taking all knowledge for their province and pursuing it by means so scientific in essence that in respect of many principles and bases all the culture and enquiry of the succeeding ages has found no need or room for improvement. With sure and serene wisdom untrammelled by the heavy cloak of magical theory, tradition, or tabu, they practised a system of medicine so soundly based that modern medicine owes it a debt whose value can hardly be exaggerated. In fact we appear to emerge, with the abruptness of a train coming out of a tunnel, from the noisome darkness of superstition into the healthy sunshine of science. Though the simile is not inapposite it presents, however, but a part of the picture, though the greater part, as will appear later.

In this present century we have heard much of protest against the dead hand of the classics. In other times formalism which sought to keep inviolate and sacrosanct the *ipsissima verba* of the Hippocratic and Galenic texts, imperfectly comprehended, inspired revolt against the written word written so long before. Nevertheless critical and unbiased examination of what remains of the original texts leaves the unescapeable conclusion that all, rebels, pioneers and pupils alike, are inheritors of the Greeks. A leading medical historian has accurately summarized the position:

> Without Herophilus we should have had no Harvey and the rise of physiology might have been delayed for centuries; had Galen's works not survived, Vesalius would never have reconstructed Anatomy, and Surgery too might have stayed behind with

her laggard sister, Medicine; the Hippocratic collection was the necessary and acknowledged basis for the work of the greatest of modern clinical observers, Thomas Sydenham, and the teaching of Hippocrates and of his school is the substantial basis of instruction in the wards of a modern hospital.—(*Charles Singer*, "The Legacy of Greece.")

Let it here be observed, as may be necessary, that while the case is in no way overstated it is based solely (and legitimately) on the products of the best Greek minds. The group of peoples known generically as the Greeks was in reality a complex mixing of races varying widely in origin, culture and mental attributes. So lacking in homogeneity was the mixture that in fact it never did blend properly, and the outstanding fact in Greek history is the perpetual jealous quarrelling of city with city and state with state, that in a very few centuries brought the whole polity to ruin and to Macedonian and Roman subjection. The Greek civilization was one of quick and brilliant achievement but, with all its lasting glory, unstable as a national entity and full of flaws.

So we find naturally enough that the Oriental heritage, both from Mesopotamian and Egyptian sources as well as the farther East, of magic and non-rational medicine was not lost and that these elements appear in some of the Greek writings, particularly those of later date. We need give them no consideration for they have no relation to the purely scientific literature with its observation and classifications of disease, its sound generalizations and its reasoned treatments. We shall, however, have to consider the pseudo-miraculous "incubation" cures of the Asklepian temples.

Who, then, were these remarkable peoples? Minoans, Mycenæans, Achæans—these were perhaps the principal races of origin. Later we find Æolian, Ionian, Dorian and Attic peoples with many sub-races and tribes. Fortunately we are not concerned to give a precise answer to a question which has long engaged the attention of scholars and still continues to do so.

Of the races mentioned the Ionians and Dorians are the only peoples who figure prominently in the medical picture. Between them they are to be credited with the greater part of the best works of the early Greek intellect, and men of their race are mainly responsible for the Greek medical system. Cos and Cnidus, the centres of early medical teaching, were Dorian colonies which included large numbers of Ionians among

their inhabitants. The Hippocratic books are written throughout in the Ionian literary dialect.

In these early, pre-Hippocratic days, a few philosophers and physicians stand out and in them we see the beginnings of the growth that led to the supremacy of the fifth century. For though we have, as has been said, the sensation of a sudden emergence from the twilight of magic-soiled medicine to the daylight of science, nothing in evolution, whether of peoples or plants is really sudden. The speculating, varied Greek mind compounded of heterogeneous racial origins and influences exhibited a breadth of outlook that inspired a dispassionate, detached appreciation of native and foreign ideas and customs. Culture attained its highest early development in the great commercial centres that arose in Ionia, then the connecting link with Egypt and the East, and many foreign elements are found in the free-thinking Ionian natural philosophy. So the Greek inquirer, while maintaining his critical attitude, secured the best of Egyptian and Assyro-Babylonian medical ideas, methods and drugs.

In the seventh century B.C., as we have seen in earlier pages, Ashurbanipal of Assyria was collecting in his great library at Nineveh all the medical lore of his kingdom. Towards the end of the same century we may see the dawn of genuine medical science. It probably began at Cnidus in Asia Minor, where, in the earliest Greek medical school, the facts of disease—not magical notions or arbitrary, empirical ideas, but properly observed facts—were collected, classified and recorded in "sentences" or aphorisms now lost. The teachers of this school are said, by the critics of the great rival school at Cos, to have treated symptom rather than patient and to have been faulty in prognosis: nevertheless although their writings are lost some of their doctrines are to be found in the Hippocratic books, a number of which show their influence. According to Hippocrates they invented the names pleurisy (*pleuritis*) pneumonia (*peripneumonia*) and *phrenitis*.

The teachers of Cos, a school of somewhat later foundation, were distinguished by emphasis on prognosis, the careful investigation of the condition of the patient rather than the symptoms of his disease and a reliance on the healing powers of nature in preference to vigorous treatment. Between them these two great schools, inheriting and developing the principles of Ionian philosophy, share the greater part of the credit for the splendour of Greek medical achievement.

Under the conditions of the time and in the absence of any bulk of detailed knowledge the Cnidian method of detailed classifica-

tion of disease by symptoms was bound to be unsuccessful, though in principle scientific, for they carried differentiation to extremes and failed in practical treatment. They had no sympathy with the general pathology of Hippocrates which his scientific genius, working with the admittedly limited knowledge of the age, elevated to an amazingly successful medical system. As Mr. W. H. S. Jones says, in the Loeb edition of the Hippocratic works, "Hippocrates did the wrong thing well: the Cnidians did the right thing badly. . . . . A dislike of theory, a careful cataloguing of symptoms . . . are characteristics that appear in several of the works in the Corpus generally considered Cnidian." He considers that Cnidian doctrine influenced medicine generally. Hippocrates himself came from a family of physicians in the island of Cos and the main principles and tendencies of Coan teaching in the fifth and fourth centuries B.C. are represented in the great Hippocratic Collection.

Before we consider the monumental work of Hippocrates and his school we must note a few of the more important ideas and principles worked out by other and earlier philosophers. Among the Ionian school of nature philosophers in the sixth century B.C. Anaximenes of Miletus and Heraclitus of Ephesus (who was perhaps a physician) propounded the doctrines of air as the primary principle with "pneuma" as the breath of life and heat and moisture with their opposites as fundamental qualities of the body. These doctrines were further developed in the South Italian (Sicilian) school. The strongest personality in the famous medical school of Croton, founded by Pythagoras of Samos in the late sixth century, was Empedocles of Agrigentum made known to every schoolboy of the last generation at least by Matthew Arnold's poem. Physician and physiologist, poet and traveller, his influence was wide, and his teaching of the four elements (earth, air, fire and water) and the four qualities (heat, cold, moisture and dryness) finally produced that sterile doctrine of the "humours" of the body, which, as we shall see in the medieval section of this work, dominated medicine until, after the Renaissance, Greek science came into the light again.

Empedocles, however, cannot be held responsible for medieval futilities. With his contemporary, Alcmæon of Croton, he developed the important principle that health depends upon harmony of the elements within the body and disease upon their discord. He also taught that "the blood is the life" and the seat of "innate heat" which he seems to have identified with the soul. The heart he regarded as the centre of the body system and the

chief organ of the "pneuma" of Anaximenes. Pneuma and air pervade the universe and the pneumatic school of physiology, which became of importance later, is due to the philosophical speculations of Empedocles.

More obviously striking perhaps were his hygienic achievements. He seems to have realized that swamp and marsh produce disease for he earned great fame by checking a plague of malaria which devastated the Sicilian town of Selinos about 480 B.C. by the expedient of joining together the two streams of the district and so (apparently) draining the marshes. Whatever he did, the pestilence was stayed, and the grateful people struck a number of beautiful coins to commemorate the city's deliverance [see Plate 15]; twelve examples of the coins are now in the British Museum.

Another outstanding personality of the pre-Hippocratic period is that of Democedes, the first physician of whom we have a trustworthy history. He was born about 520 B.C., and according to Herodotus was an extremely successful public medical officer. His career shows that there was a public medical service well organized and regarded as being of high importance in the second half of the sixth century, at least two generations before Hippocrates. In his second year as state physician of Ægina Democedes received a salary of one talent, almost equal to £500 in our money. He then spent a year at Athens at an increased fee, and in the fourth year Polycrates, tyrant of Samos, secured his services at double the rate paid by Ægina. Public inscriptions tell us of equal honours paid to other physicians. These state physicians were clearly distinguished men whose services were much esteemed and keenly sought for. They were entirely secular and independent of the Asklepieion temples. References to their election by popular assembly occur in Plato's *Dialogues*. They may be seen at work in fifth century vase paintings [Plate 20].

The form of public medical treatment which engages the attention of most popular writers on medicine in ancient Greece, and to which, perhaps, undue prominence has been given in the past, is that of the priestly, semi-religious rites of the temple of Asklepios, the Roman Æsculapius. Certainly the material remains bulk largely. Over three hundred temples to Asklepios are known to have been built. The finest ruins are those of the temple at Epidaurus [Plate 15] which was perhaps the greatest centre of the cult. The festivals there were so popular that the buildings included a theatre—one of the most beautiful Greek structures that remain—which would hold twenty thousand

spectators, and a stadium seating twelve thousand. Dr. Caton in his restoration of the ruins of the Asklepieion, shows in addition among the many buildings a central shrine of Asklepios, another to his daughter Hygeia, a great abaton (the sleeping place for the sick), baths, hostels and a probable library site.

Obviously a highly successful and wealthy centre. Excavations at Cos have shown that the Asklepieion there was almost equally successful. The treatment supplied must therefore have been one of direct appeal to the masses of the people and since it was, in a large degree, faith-healing we can understand its success.

Other centres of which Greek ruins persist are to be seen at Athens, Pergamos and even as far afield as Butrino in Albania. As we have seen similar temples devoted to the gods of healing and the service of the sick existed in Egypt and, judging by votive offerings and other records, a system of treatment not greatly dissimilar was in vogue.

These temples probably date from the eighth or early seventh centuries B.C. Their patron, the divine Asklepios, whose serpent still remains the emblem of healing [Plate 18], was a chief of Thessaly who fought in the Trojan Wars. His two sons are described by Homer as skilled physicians. By 770 B.C. a Greek poet, Arctinus, invests him with supernatural attributes and soon after the temple worship began. In them developed a semi-miraculous system of treatment known as "incubation".

The "incubation" sleep, in which the god gave the sleeping patient instructions for his cure, or performed the cure itself, was the main part of the ritual of treatment. After performing certain sacrifices and ritual washings the patient lay down at night in the abaton, an airy sleeping chamber open on the south side, an arrangement that probably did much to bring credit to the god by assisting recovery [Plate 16]. The priest recited prayers begging for divine help for the sick. According to the inscriptions the god frequently appeared in the dreams of the patient, or in person, diagnosed his ailment and spoke of its treatment. Probably the priest himself in the dim light acted the part of the god and it seems likely that the patient was also drugged or narcotized. The treatment is described in the *Plutus* of Aristophanes, and despite the poet's satire it is a clear account of the ritual employed. Perhaps the modern study of dreams may be regarded as in some small part a reversion to Asklepian methods. Of the nature of the cases treated and the cures achieved some of the votive tablets from Epidaurus give a reasonably fair idea. We quote a few.

> A man who had only one eye is visited by the god in the abaton. The god applies an ointment to the empty orbit. On awakening the man finds he has two sound eyes.—(*Caton.*)

> Heraicus of Mytilene is bald and entreats the god to make his hair grow. An ointment is applied by Asklepios, and the next morning he has a thick crop of hair.

These are certainly cases of miracle-mongering, and we need expend no space in their discussion. Another type of case is susceptible of the explanation already suggested that the priest masqueraded as the god since he obviously performed the operation described:

> A man had an abdominal abscess. He saw a vision and thought that the god ordered the slaves that accompanied him to lift him up and hold him, so that his abdomen could be cut open. The man tried to get away, but his slaves caught him and bound him. So Asklepios cut him open, rid him of the abscess, and then stitched him up again, releasing him from his bonds. Straightway he departed cured, and the floor of the abaton was covered with blood.—(*Hamilton.*)

In another case dropsy is treated in the truly heroic manner. Asklepios (according to the patient's dream as described in the inscription) cuts off the patient's head, holds him upside down to let the fluid run out and then replaces the head! A simpler case of faith-healing is probably revealed in the following invocation:

> Oh, blessed Asklepios, God of Healing, it is thanks to thy skill that Diophantes hopes to be relieved from his incurable and horrible gout, no longer to move like a crab, no longer to walk upon thorns, but to have sound feet as thou hast decreed.

In later times, as Dr. Caton points out, superstition and semi-fraud gave way to a larger extent to genuine healing. The earlier priests prescribed "many things that were prudent and judicious; plain and simple diet, hot and cold baths, poulticing for certain chest ailments and a variety of medicaments."

In the Asklepieion some have seen a prototype of the modern hospital, since patients were received for periods of different length, and attention was paid to diet, exercise, massage and bathing. It is a point worthy of remark that these temples flourished in places that were natural health resorts, some with mineral or hot springs as well. Moreover secular Asklepiads

PLATE XV

When Empedocles Stayed the Malaria Plague

These coins of Selinos, Sicily, are believed to have been struck about 480 B.C., to commemorate the deliverance of the city from a malaria plague by the action of Empedocles (*see* page 46). Both coins show sacrifice being offered to Asklepios and a leaf of the wild celery, after which the town was named.

On the obverse of one coin Apollo is seen in his chariot shooting the health-giving arrows—the sun's rays—and on the other Heracles subduing the Cretan Bull.

British Museum.

Reconstruction of the Asklepian Temple Buildings at Epidaurus

This reconstruction, based on the excavations of the Greek Archæological Society of the extensive ruins at Epidaurus, shows, on the left, the Tholos or rotunda: in the centre, the Abaton where the patients slept: and on the right, the temple of the god. There were also many other buildings in this very successful centre of healing and miracle. The ruins of the great Theatre are among the most beautiful that exist in Greece.

From "Monuments Antiques".

PLATE XV

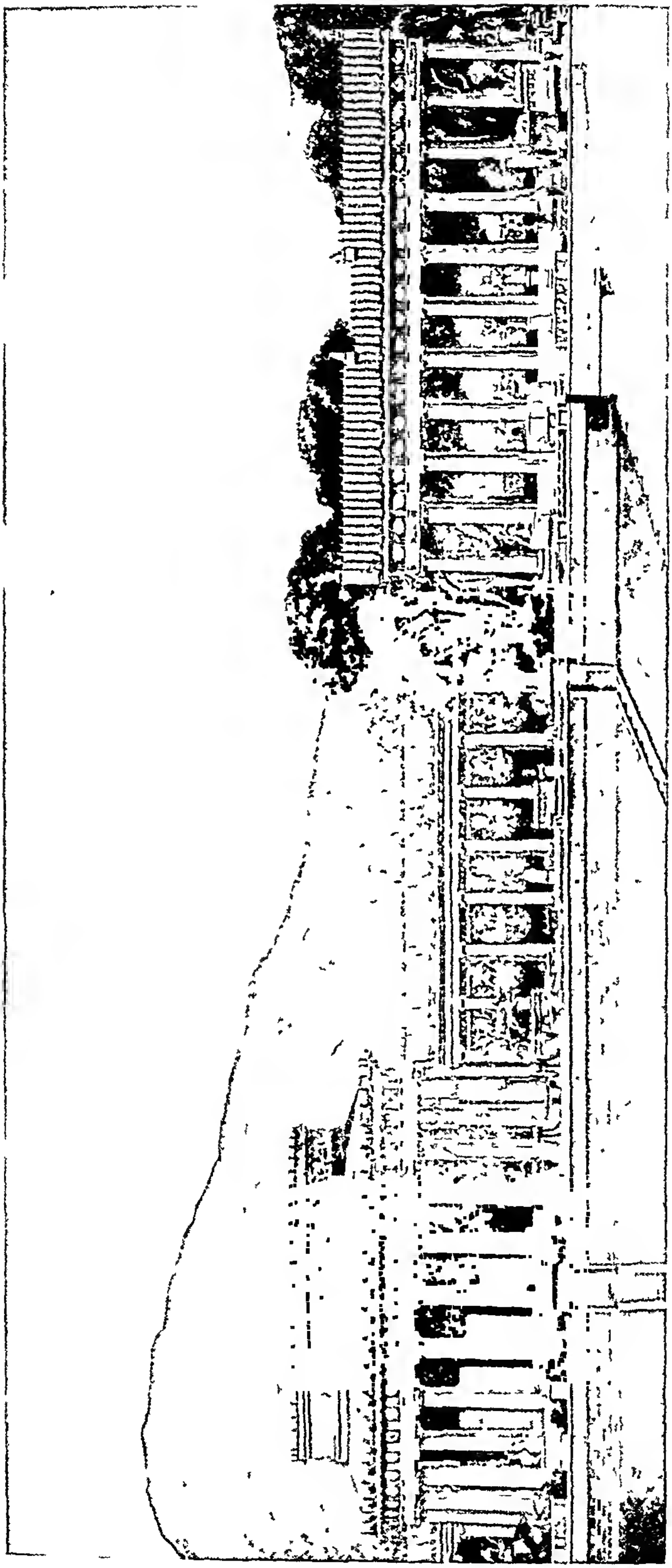


Plate XVI

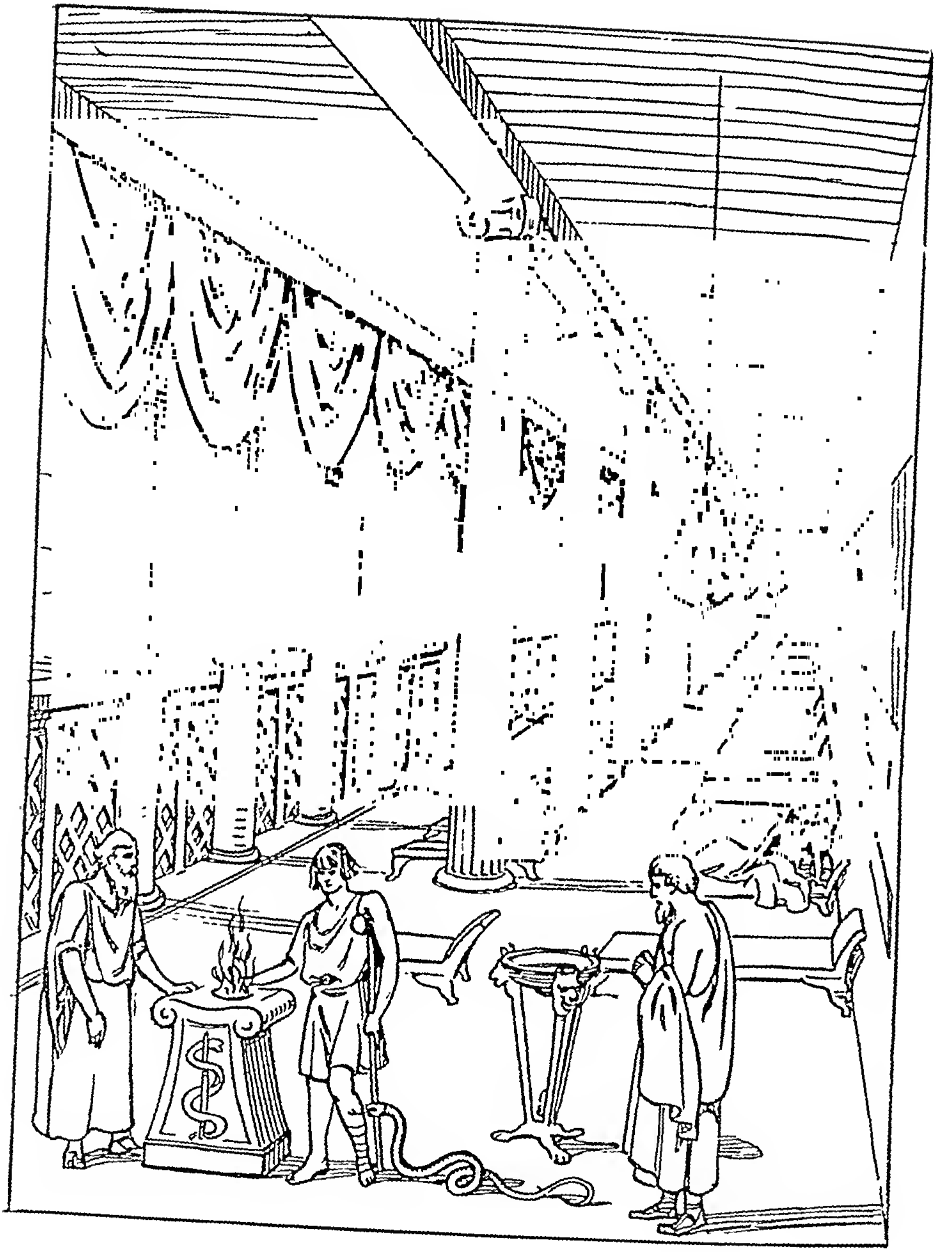


PLATE XVI

Where the Asklepian Cures were Wrought

In this reconstruction drawing, after Dr. Caton, the interior of the Abaton, or open-fronted portico, is seen. Here the patients slept, and during their sleep the god visited them in their dreams and indicated or completed the cure desired. One patient stands before an altar making his offering to the priests, while the sacred serpent licks his wound.

After Caton "Temples and Ritual of Asklepios at Epidaurus."

were apparently attached who were free from the temple superstitions and its theurgic rites. Hippocrates himself was an Asklepiad of Cos. But while the temples may be supposed to have provided rich clinical material for study—and indeed Pliny and Strabo both declare that Hippocrates was indebted to the temple tablets describing disease—there seems no doubt that the Asklepiads were not priests, but probably a guild, and that Greek medicine owes little if anything to the temples.

Dr. Withington is of opinion that if the inscriptions at Cos resembled those found at Epidaurus, they can only have warned Hippocrates what a clinical history should not be.

Greek medicine in fact like other Greek activities was so little hampered by bonds of any kind that its forms of practice were manifold. In addition to the priests of the Asklepian temples and the state physicians we have, before Hippocrates, several other classes of healers including the philosophers, gymnastic trainers (who were consulted in diet questions, injuries, exercises and massage), various forms of empirics and quacks, medicinal root collectors, pharmacopolists or druggists (of somewhat sinister significance since the word *pharmakon*, a medicine or remedy, originally meant a poison), and even "wise women" and midwives of none too savoury a reputation.

By the middle of the fifth century genuine Greek medicine and the limited knowledge and experience it had laboriously acquired was in danger of being lost in a quagmire of sophistry and speculative philosophy, with its unverified postulates and charlatanry, such as actually overwhelmed it in the Dark Ages. Then with the appearance of the mysterious, towering figure of the great Father of Medicine and his followers and pupils "the Art" becomes a free and unfettered profession and Hellenic medicine attains a high measure of rational science and an even greater moral dignity.

Of Greek hygiene in the Golden Age and later little more than generalities can be given. Archæology has given most of her attention to the temples, and no one has done for the domestic architecture of the Greeks what Sir Arthur Evans has done for that of the Cretans. Wiegand has examined the ruins of the small towns of Priene and Miletus in Asia Minor but they are mainly of the later, Hellenistic, period. At Priene water-closets of modern type were discovered. The following information is mainly from literary sources. Each house of more than moderate means had a room set aside for bathing, which was placed outside and near the terrace. Large houses had great stone basins. After exercise

or fatigue of any kind the Greek took a bath, generally hot; cold baths were considered tonic.

Aristophanes characterizes a person unable to get a bath as "poor and dirty." He must have been for there were public baths (two oboles entrance fee) as well as private, and Heredotus speaks of hot-air baths. Bathing is a frequent subject of the vase paintings, including public baths for women, as may be seen on vases in the British Museum and the Louvre. Baths were attached to all the great gymnasia.

Lucien says that the house directed towards the East was considered the best. The windows were to be open to all points of the horizon to ensure that the house was bright, bathed in the rays of the sun and also well-aired and ventilated thereby.

Matters of public hygiene were the concern of city officers. Town planning, street arrangement, water supply and sewage disposal were all considered and regulated, particularly under Pericles and other Tyrants in the fifth century. Plato in his *Laws* discusses the necessity for the canalization of soiled water and the free supply of good water. The drains and sewers of Athens are said to have been well constructed. The great sewer ended in a tank, from which brick conduits distributed the contents over open ground well outside the city.

CHAPTER V

GREECE: THE FATHER OF ALL MEDICINE

Vita brevis, ars longa est. 'Life is short, the Art long,' opportunity fleeting, experience treacherous/or, deceptive/judgement difficult. The physician must be ready, not only to do his duty himself, but also to secure the co-operation of the patient, of the attendants and of the externals.

THIS, PERHAPS the most famous of all the "Aphorisms" of the Hippocratic Collection, together with the great Hippocratic Oath itself, exposes a creed that raises professional medical ethic and professional medical method to the highest pinnacle of aspiration, the symbol of the highest ideal and the embodiment of a new era of immortal power in the quest for health.

Hippocrates was born in the island of Cos about 400 B.C., the son of an Asklepiad, and a pupil, and later a teacher, in the medical school of Cos. Beyond the facts that he travelled widely, possibly lived a while in Athens, and died at Larisa at the great age of—according to different traditions—from eighty-five to one hundred and nine years we know nothing in detail of his actual life. His fame is almost beyond recounting. Even in his lifetime he was known as "the Great" and Plato placed him in equality with two of the master artists of all time—Polycletus and Pheidias. His shadowy figure is behind all Greek medical writing and the best practice till barbarian darkness descends [Plate 19].

His period, it is perhaps worth recalling obvious though it be, is that of the high tide, the full flower of Hellenic life. The glorious fifth century saw the incomparable achievements of Pericles and Socrates, Plato, Thucydides, Sophocles, Euripides, Aristophanes, Pheidias, Polycletus and Praxiteles and many another of the great ones, the mere mention of whose names is almost an inclusive catalogue of human intellectual capacity.

When we speak of Hippocrates and his school it is difficult to avoid the appearance of easy and fulsome laudation. Let us first notice the conditions and limitations of contemporary

medicine. The Greek knew nothing of bacteria and infection (although the Hippocratic work *Epidemics* acknowledges that consumption is contagious while stating that fevers are not), his *apparatus medicus* was primitive by modern standards, and his actual store of medical knowledge was necessarily small, for but little time had been available for the accumulation of pathological facts. He knew something of disease and the course it ran, and even of its cure. Many parts of the Hippocratic books are open to criticism or even condemnation by our standards. There is also a mixture of medicine and sophistic philosophy in them which represents one of the main obstacles to steady scientific advance at that time.

Superstition and divine notions of disease had been relegated to quacks and the temples. Then came philosophy with its perpetual search for uniformity in the chaos of unordered natural phenomena and endeavoured to include medicine within the scope of its soaring guesswork. Philosophy is even now but rarely in touch with the dull, plodding, fact-by-fact registration of science. Then it never was. The Greek word hypothesis (*upothesis*) was not that used by the modern man of science who, having accumulated and ordered his facts, frames a hypothesis to account for them. Plato and the Sophists started with a hypothesis on which their scheme of ideas was erected, just as the beautifully ordered propositions of Euclid depend upon certain unverifiable axioms or postulates. The Greek *upothesis* is, therefore, best translated as 'postulate.' Such *a priori* assumptions are useless in science and dangerously useless in medicine. Celsus, the Roman medical writer, ascribes to Hippocrates the credit for the separation of medicine from philosophy, and the six or seven books of the Hippocratic Canon are as free from the sophistry of the philosophers as they are from the dogmas of religion which sterilized all earlier tendencies to scientific progress.

It is not necessary to dilate further upon the failings of Greek medicine. As in our own time, so throughout the fifth century and later periods, quackery and charlatanry, magic and sophistry, flourished alongside science. There was no state control and any person could set up as a healer without qualification. There remain the incontrovertible facts that for over two thousand four hundred years Hippocrates has been acknowledged as the Father of Medicine, and that the Hippocratic ethic established the highest set of ideals, still acclaimed by the profession the world round.

The ethical keynote is struck by the great Oath of Service laid upon the neophyte which, in the twentieth century, still shines as a beacon light and is still incorporated in the teachings of not a few European medical schools. It has so often been quoted that to the student of medical history it is a glorious commonplace, but it cannot be omitted here. The translation that follows is taken from Mr. W. H. S. Jones' edition of *Hippocrates:*

> I swear by Apollo Physician, by Asclepius, by Health, by Panacea, and by all the gods and goddesses, making them my witnesses, that I will carry out, according to my ability and judgement this oath and this indenture.
>
> To hold my teacher in this art equal to my own parents; to make him partner in my livelihood; when he is in need of money to share mine with him; to consider his family as my own brothers and to teach them this art, if they want to learn it, without fee or indenture; to impart precept, oral instruction, and all other instruction to my own sons, the sons of my teacher, and to indentured pupils, but to nobody else.
>
> I will use treatment to help the sick according to my ability and judgement, but never with a view to injury and wrong-doing.
>
> Neither will I administer a poison to anybody when asked to do so, nor will I suggest such a course. Similarly I will not give a woman a pessary to cause abortion. But I will keep pure and holy both my life and my art.
>
> I will not use the knife, not even, verily, on sufferers from stone, but I will give place to such as are craftsmen therein.
>
> Into whatsoever houses I enter I will enter to help the sick and I will abstain from all intentional wrong-doing and harm, especially from abusing the bodies of man or woman, bond or free.
>
> And whatsoever I shall see or hear in the course of my profession, as well as outside my profession in my intercourse with men, if it be what should not be published abroad I will never divulge, holding such things to be holy secrets.
>
> Now if I carry out this oath and break it not, may I gain for ever reputation among all men for my life and for my art; but if I transgress it and forswear myself, may the opposite befall me.

The origin and particular application of these noble rules are matters for the controversy of scholars. We need only note that they are genuinely Hippocratic. The phrase "I will keep holy both my life and my art" is of special interest. Throughout the writings medicine is spoken of as an art, and one thesis is entitled "The Art." The fine arrogance of this claim is better realized when we remember that in the Platonic philosophy art (*tekne*) is held almost in contempt beside the altitudes reached by the intellect unhampered by dull fact. In one of the later books its warm humanity is emphasized in the phrase "Where there is love of man, there is also love of the Art."

What is the Hippocratic Collection, and what is its real significance?

It consists of some sixty "books" or writings of varying dates, mainly on medical and health subjects. Scholarship has decided in general that six or seven of them are to be accepted as the genuine Hippocratic Canon, that is, perhaps written by Hippocrates himself, and certainly written by his school in his time. Others are compilations or copies of later date from the same century to Romano-Greek times. From one hundred to three hundred years separate the earliest from the latest works. The collection is a medley and, as we have it now, a set of copies collected and recopied by the scientific school at Alexandria in the second century A.D. The earliest MS. of the large number that exist is in Byzantine Greek of the ninth century. Mr. W. H. S. Jones' theory that the collection is the remains, with later additions, of the original library of the Hippocratic school at Cos is perhaps the most satisfactory explanation of its origin. It would account for much of the miscellaneous character of the collection and its many unrelated items.

The six books of the Canon which we shall note are:

(1) the *Prognostic* (always attributed to Hippocrates himself and the keynote of his system);

(2) *Regimen in Acute Diseases* (supplementary to the *Prognostic*);

(3) *Epidemics*, Books I and III (really continuous);

(4) *Aphorisms* (perhaps by Hippocrates himself; these pregnant sentences were, says Withington, "for ages classed among the most wonderful products of human genius");

(5) *Airs, Waters, Places* (the first book on medical geography, climatology, etc.);

(6) *The Sacred Disease* (a rational discussion of epilepsy and other brain seizures, perhaps written by a pupil of the writer of *Airs, Waters, Places*).

It will be clear that when the historian speaks of Hippocrates the name is understood to be enlarged to the phrase, "Hippocrates and/or the Hippocratic writers."

Of the significance of the Hippocratic Canon we cannot do better than allow it to speak for itself, making such comments as appear necessary. All the quotations are taken, by permission,

from Mr. W. H. S. Jones' fine edition of Hippocrates in the Loeb Classical Library (Heinemann).

The *Prognostic* is a work of general pathology and a medical history of acute diseases. It begins:

> I hold that it is an excellent thing for a physician to practise forecasting. For if he discover and declare unaided by the side of his patients the present, the past and the future, and fill in the gaps in the account given by the sick, he will be the more believed to understand the cases, so that men will confidently entrust themselves to him for treatment. Furthermore, he will carry out the treatment best if he know beforehand from the present symptoms what will take place later.
>
> Now to restore every patient to health is impossible. To do so indeed would have been better even than forecasting the future. But as a matter of fact men do die, some owing to the severity of the disease before they summon the physician, others expiring immediately after calling him in—living one day or a little longer—before the physician by his art can combat each disease.
>
> It is necessary, therefore, to learn the nature of such diseases, how much they exceed the strength of men's bodies, and to learn how to forecast them. For in this way you will justly win respect and be an able physician. For the longer time you plan to meet each emergency the greater your power to save those who have a chance of recovery, while you will be blameless if you learn and declare beforehand those who will die and those who will get better.

Then follows immediately the famous passage dealing with the signs of approaching death which is known to medicine to-day as the "Hippocratic facies":

> In acute diseases the physician must conduct his inquiries in the following way. First he must examine the face of the patient, and see whether it is like the faces of healthy people, and especially whether it is like its usual self. Such likeness will be the best sign, and the greatest unlikeness will be the most dangerous sign. The latter will be as follows. Nose sharp, eyes hollow, temples sunken, ears cold and contracted with their lobes turned outwards, the skin about the face hard and tense and parched, the colour of the face as a whole being yellow or black.
>
> If at the beginning of the disease the face be like this, and if it be not yet possible with the other symptoms to make a complete prognosis, you must go on to inquire whether the patient has been sleepless, whether his bowels have been very loose, and whether he suffers at all from hunger. And if anything of the kind be confessed, you must consider the danger to be less.
>
> The crisis comes after a day and a night if through these causes the face has such an appearance. But should no such confession be made, and should a recovery not take place within this period, know that it is a sign of death.

If the disease be of longer standing than three days when the face has these characteristics, go on to make the same inquiries as I ordered in the previous case, and also examine the other symptoms, both of the body generally and those of the eyes. For if they shun the light, or weep involuntarily, or are distorted, or if one becomes less than the other, if the whites be red or livid or have black veins in them, should rheum appear around the eyeballs, should they be restless or protruding or very sunken, or if the complexion of the whole face be changed—all these symptoms must be considered bad, in fact fatal.

You must also examine the partial appearance of the eyes in sleep. For if a part of the white appear when the lids are closed, should the cause not be diarrhoea or purging, or should the patient not be in the habit of so sleeping, it is an unfavourable, in fact a very deadly symptom. But if, along with one of the other symptoms, eyelid, lip or nose be bent or livid, you must know that death is close at hand. It is also a deadly sign when the lips are loose, hanging, cold and very white.

These paragraphs (the book runs to twenty-five in all) bring out two important features—the accurate noting of details, the recognition of the essential with the exclusion of all irrelevancies, and the importance attached to knowledge of the course of the disease. This wish to know the future was a strong characteristic of the Greek mind which, in all aspects of doubt, turned to oracle, divination or augury. It is curious, as most commentators have remarked, that prognosis is considered to be so much more important than diagnosis. Diseases are named but not classified and acute diseases are the writer's chief concern. In the astonishing series of clinical histories included in the *Epidemics* (but in fact illustrating the thesis on *Prognostic*) we find no diagnosis such as, according to Hippocrates' complaint, was carried to extremes by the physicians of Cnidus. This concern with the future of an illness is no mere matter of prophecy, however. It includes the whole natural history of the disease and its relation to the human organism, which is a fundamental part of medicine. Without this knowledge treatment is arbitrary. "Just as the revival of Hippocratic observation in the seventeenth century gave a new birth to clinical medicine so the revival of Hippocratic prognosis in our own days . . . had no small share in bringing about the more modern revolutions in medical practice."—(*Withington.*)

The essential simplicity of Hippocratic treatment and its unpretentious nature, its utter lack of diagnostic boasting or loud promises of cure—such as brought so much of the craft to disrepute in Plato's day and disfigured in later centuries the

PLATE XVII

Votive Reliefs in Honour of Asklepios

These reliefs represent the faith-healing aspect of early Greek medicine. In the one above a sick man's litter has stopped by a tree, on which hangs the sacred snake. In that below, the snake is seen beneath the throne on which the god sits. By his side stands Hygieia, his daughter, the goddess of health. In front are two suppliants.

Ny Carlsberg and Athens National Museums; photos, Mansell and Alinari.

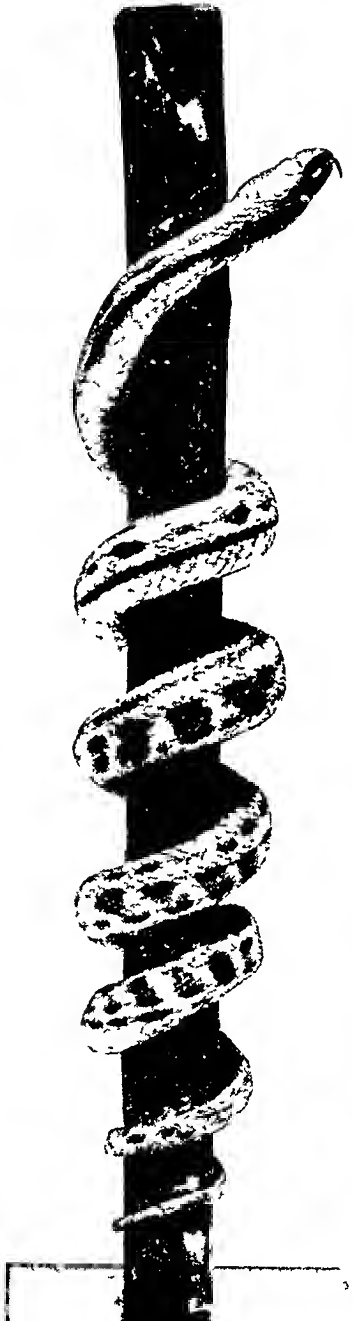


PLATE XVIII

Persistence of the Sacred Serpent of Healing

As long as the recorded history of medicine is the association with it of the serpent of healing. It is clearly seen in the Sumerian vase (left) which dates from 2350 B.C., and was dedicated by Gudea of Babylon to Ningishzida, son of Ninazu, the Master Physician. It is always associated with Asklepian monuments (*see* Plate XVII).

The same serpent is recognisable in the existing species (right), *Coluber longissimus* (*Æsculapius*). The species was named after Asklepios by Aldrovandi of Bologna (1522–1605), and has generally been regarded as the true serpent of Asklepios. It is found in various parts of Europe. It remains the emblem of the art of healing and is found in many official badges and seals, including that of the Royal Army Medical Corps.

work of men of real greatness—are well seen in the next two works on our list, the *Regimen in Acute Diseases* and the *Epidemics*.

In these two books we also have a fairly complete statement of the Greek knowledge of diseases, their recognition and their treatment. It is beyond question a marvellous achievement. Mr. Jones considers the *Epidemics* to be "the most remarkable product of Greek science."

From the *Regimen* we learn that the mild treatment included but a few drugs—hellebore and other simple purges and herbal drinks made from raisins, wheat, saffron, pomegranates "and so forth." Its mainstay appears to be barley gruel and barley water with hydromel (honey and water) as a soothing drink and oxymel (honey and vinegar) as an expectorant. Detailed instructions are given for the preparation of the gruel and long discussions of its effects. Ordinary water is considered to be definitely harmful. No other form of nourishment is mentioned in these cases although dietetics played an extremely important part in the Hippocratic method. Other therapeutic measures recommended in *Acute Diseases* (which appear to be mainly confined to chest complaints) are baths (with affusions, sponging, scraping, rubbing) wet and dry fomentations, bran poultices, enemata and suppositories, for all of which careful directions are given.

From this work and the greater work the *Epidemics* we learn the main diseases with which the Greek physician had to grapple. Many of them carry to-day the names he gave them. Malaria in all forms was the greatest foe. Symptoms and consequences of the mild and malignant fevers and of the intermittent forms are vividly and accurately described. One of its consequences, mental and physical prostration, was named melancholia (*melagkolia*). Among other diseases whose names are Greek in origin (transliterated here) were diarrhoea (*diarroia*), dysentery (*dusenteria*), pleurisy (*pleuritis*), pneumonia (*peripneumonia*), consumption (*phthisis*), ophthalmia (*ophthalmia*).

Something must be said of the principal doctrines inculcated in these works. They are four—coction, crisis, the critical days and the natural healing power. In the background were the humours (propounded by the earlier Pythagorean school as we have seen) whose harmony was health, and whose disturbance was disease, the most important here being bile and phlegm. The working theory, the practical man's guide, was provided by the four doctrines. The first is difficult for the modern mind to appreciate. Coction (*pepsis*) is the process tending to recovery which gradually restores and perfects the equilibrium of the

humours. This restoration was due, according to the fourth doctrine, to the powers of nature (the famous *vis medicatrix naturæ*) aided to the limit of the physician's powers by removing disturbing factors, including incorrect diet, as far as possible without active interference. That natural restoration was made by coction and the day it occurred or definitely failed was the day of crisis (*krisis*). Recovery or death followed. If the crisis was favourable the signs of coction were to be seen in the evacuation, through the usual excretory channels, of the residue of the humours after equilibrium was restored.

If normal evacuation by mouth, rectum, urethra or skin pore, failed the morbid residue might be concentrated at one point and an eruption, tumour or even gangrene might result. This, called *apostasis*, is ingeniously translated by Mr. Jones as "an abscession."

The third doctrine, the law of critical days, was perhaps in part a survival of the Pythagorean ideas of mystic numbers but more probably was associated with the periodical variations of malaria which, as has been noted, was the principal disease.

The fourth doctrine, with its associated expectant form of treatment, seems to us so obvious as to require no comment. Actually it is one of that great collection of splendid platitudes which make Greek ideas seem so obvious and simple to unhistorical and imperceptive minds and prove on examination to be fundamental and original contributions to human thought.

> We live some twenty-three centuries later than Hippocrates; for some sixteen of those centuries the civilized world thought that to retain health periodical bleedings and potions were necessary; for the last century or two we have been gradually returning on the Hippocratic position.—(*Charles Singer*, "The Legacy of Greece".)

The great *Epidemics*, books I and III, which though numbered thus in all the MSS., are really continuous, are genuinely Hippocratic.

Their associated clinical histories, bedside notes of cases written with utter sincerity, devoid of any form or sign of self interest or care for anything but untainted scientific truth, are the only records of their kind for over eighteen hundred years and would not easily be improved upon as models even in these modern days.

The book is in two somewhat disconnected parts. One, traditionally called "Constitutions" consists of descriptions of climatic conditions of definite type associated in the writer's

view with the spread of disease of epidemic type. (It is amusing to note in passing that the weather described in these reports includes specimens of a kind familiar to modern ears—Winter was northerly; many violent and abundant rains; . . . there were fine intervals!) The other is a series of histories of acute diseases of specific individuals and has but little connection with the first part as has already been noted.

The most important diseases discussed in the Constitutions, which the writer considers to be epidemic are consumption and the various forms of malaria. The following general description of the former disease and its victims, taken from *Epidemics* III, displays a very high standard of accuracy and practical medical knowledge:

> The severest and most troublesome disease, as well as the most fatal, was the consumption. Many cases began in the winter, and of these several took to their bed, though some went about ailing without doing so. Early in the spring most of those who had gone to bed died, while none of the others lost their cough, though it became easier in the summer.
>
> During autumn all took to bed and many died. Most of these were ill for a long time. Now most of these began suddenly to grow worse, showing the following symptoms: frequent shivering; often continuous and acute fever; unseasonable, copious, cold sweats throughout; great chill with difficult recovery of heat; bowels variously constipated, then quickly relaxing, and violently relaxing in all cases near the end; the humours about the lungs spread downwards; abundance of unfavourable urine; malignant wasting.
>
> The coughs throughout were frequent, bringing up copious, concocted and liquid sputa, but without much pain; but even if there was pain, in all cases the purging from the lungs took place very mildly. The throat did not smart very much, nor did salt humours cause any distress at all. The fluxes, however, viscid, white, moist, frothy, which came from the head, were abundant. But by far the worst symptom that attended both these cases and the others was the distaste for food, as has been mentioned. They had no relish either for drink with nourishment, but they remained entirely without thirst. Heaviness in the body. Coma. In most of them there was swelling, which developed into dropsy. Shivering fits and delirium near death.
>
> The physical characteristics of the consumptives were:—skin smooth, whitish, lentil-coloured, reddish; bright eyes; a leucophlegmatic condition; shoulder-blades projecting like wings. Women too so. As to those with a melancholic or a rather sanguine complexion, they were attacked by ardent fevers, phrenitis and dysenteric troubles. Tenesmus affected young, phlegmatic people; the chronic diarrhoea and acrid, greasy stools affected persons of a bilious temperament.

A most interesting point in the last paragraph of this quotation is that here we see reasonably and sanely applied that doctrine of the humours which, as we have noted, became in other hands a sterilizing influence during seventeen hundred years of medicine. In Hippocratic medicine it is at least similar in nature to the modern study of individual temperaments and constitutions.

Malaria is described with equal accuracy and attention to relevant detail. Following several pages of similarly important character we have a paragraph of the highest significance which not only illustrates the application of the doctrines of crisis, coction and "abscession" referred to above, but lays down in a few pregnant sentences the whole duty of the physician:

> In all dangerous cases you should be on the watch for all favourable coctions of the evacuations from all parts, or for fair and critical abscessions. Coctions signify nearness of crisis and sure recovery of health, but crude and unconcocted evacuations, which change into bad abcessions, denote absence of crisis, pain, prolonged illness, death or a return of the same symptoms. But it is by a consideration of other signs that one must decide which of these results will be most likely. Declare the past, diagnose the present, foretell the future; practise these acts. As to diseases, make a habit of two things—to help, or at least to do no harm. The art has three factors, the disease, the patient, the physician. The physician is the servant of the art. The patient must co-operate with the physician in combating the disease.

We turn to the incomparable clinical histories. It has often been remarked that in his attachment to the purely relevant parts of the case under observation and the total exclusion of all irrelevancies the physician, in recording these observations is no longer healer but the detached scientist. He does not consider the cure and shows no emotion in recording, as he does in twenty-five cases out of forty-two, that the patient dies.

Where all are of outstanding interest and historical importance selection is difficult but the following three cases must suffice:

> Chærion, who lay sick in the house of Demænetus, was seized with fever after drinking. At once there was painful heaviness of the head; no sleep; bowels disturbed with thin, rather bilious stools.
>
> *Third day.* Acute fever, trembling of the head, particularly of the lower lip; after a while rigor, convulsions, complete delirium; an uncomfortable night.
>
> *Fourth day.* Quiet; snatches of sleep; wandering.
>
> *Fifth day.* Pain; general exacerbation; irrational talk; uncomfortable night; no sleep.

Sixth day. The same symptoms.

Seventh day. Rigor; acute fever; sweating all over; crisis.

This patient's stools were throughout bilious, scanty and uncompounded. Urine thin, not of a good colour, with a cloudy substance floating in it. About the eighth day the urine had a better colour, with a slight, white sediment; quite rational and no fever; an intermission.

Ninth day. Relapse. About the fourteenth day acute fever.

Sixteenth day. Vomited bilious, yellow matters rather frequently.

Seventeenth day. Rigor; acute fever; sweating; crisis ended the fever.

Urine after relapse and crisis of a good colour, with a sediment; no delirium during the relapse.

Eighteenth day. Slight heat; rather thirsty; urine thin, with cloudy substance floating in it; slight delirium.

Nineteenth day. No fever; pain in the neck; sediment in urine.

Twentieth day. Complete crisis.

Could anything be more modern in feeling, i.e. permanently true in tone and character, than this and the following set of calmly observed bedside records? Note in the first excerpt from this twenty-five-century old case-book the double crisis and final recovery.

In Thasos Pythion, who lay sick above the shrine of Heracles, after labour, fatigue and careless living, was seized by violent rigor and acute fever. Tongue dry; thirst; bilious; no sleep; urine rather black, with a substance suspended in it, which formed no sediment.

Second day. About mid-day chill in the extremities, especially in the hands and head; could not speak or utter a sound; respiration short for a long time; recovered warmth; thirst; a quiet night; slight sweats about the head.

Third day. A quiet day, but later, about sunset, grew rather chilly; nausea; distress; painful night without sleep; small, solid stools were passed.

Fourth day. Early morning peaceful, but about mid-day all symptoms were exacerbated; chill; speechless and voiceless; grew worse; recovered warmth after a time; black urine with a substance floating in it; night peaceful; slept.

Fifth day. Seemed to be relieved, but there was heaviness in the bowels with pain; thirst; painful night.

Sixth day. Early morning peaceful; towards evening the pains were greater; exacerbation; but later a little clyster caused a good movement of the bowels. Slept at night.

Seventh day. Nausea; rather uneasy; urine oily; much distress at night; wandering; no sleep at all.

Eighth day. Early in the morning snatches of sleep; but quickly there was chill; loss of speech; respiration thin and weak; in the evening he recovered warmth again; was delirious; towards morning slightly better; stools uncompounded, small, bilious.

Ninth day. Comatose; nausea whenever he woke up. Not over thirsty. About sunset was uncomfortable; wandered; a bad night.

Tenth day. In the early morning was speechless; great chill; acute fever; much sweat; death.

In this case the pains on even days.

The distress spoken of in the above case was probably abdominal. The fever ran a rapid course and was intermittent with recurring severe exhaustion. In the third example the fever ran for three weeks and for the greater part of the time the patient was delirious or unconscious. The description is particularly vivid. For a comment on the obvious intervals between visits see below.

In Thasos the wife of Delearces, who lay sick on the plain, was seized after a grief with an acute fever with shivering. From the beginning she would wrap herself up, and throughout, without speaking a word, she would fumble, pluck, scratch, pick hairs, weep and then laugh, but she did not sleep; though stimulated the bowels passed nothing. She drank a little when the attendants suggested it. Urine thin and scanty; fever slight to the touch; coldness of the extremities.

Ninth day. Much wandering followed by return of reason; silent.

Fourteenth day. Respiration rare and large with long intervals, becoming afterwards short.

Seventeenth day. Bowels under a stimulus passed disordered matters, then her very drink passed unchanged; nothing coagulated. The patient noticed nothing; the skin tense and dry.

Twentieth day. Much rambling followed by recovery of reason; speechless; respiration short.

Twenty-first day. Death.

The respiration of this patient throughout was rare and large; took no notice of anything; she constantly wrapped herself up; either much rambling or silence throughout.

Note the absence of all diagnosis and of treatment beyond purging. It has been one of the occupations of medical writers in all times to supply the missing diagnosis. These three examples from the forty-two are given to support and illustrate the claims made earlier for the supremacy of this department of Hippocratic medicine.

The only other comment that seems to be required is the mention of "attendants". This, as Mr. Jones has noted, is with the exception of a later book, *Decorum*, not included in the Canon, the only indication of a Greek system of nursing. Obviously the physician must have had some of the many daily observations reported to him, and if the attendants were not trained nurses they must have had some medical knowledge. The passage from *Decorum* referred to gives the clue.

> Let one of your pupils be left in charge, to carry out instructions without unpleasantness, and to administer the treatment. Choose out those who have been already admitted into the mysteries of the art, so as to add anything necessary, and to give treatment with safety. He is there also to prevent those things escaping notice in the intervals between visits. Never put a layman in charge of anything, otherwise if a mischance occur the blame will fall on you. Let there never be any doubt about the points which will secure the success of your plans, and no blame will attach to you, but achievement will bring you pride. So say beforehand all this at the time the things are done, to those whose business it is to have fuller knowledge.

This book gives us several sidelights of historical value of Greek medicine. One of the more humanly amusing indicates a difficulty which is not unknown to the modern general practitioner.

> Keep a watch also on the faults of the patients, which often make them lie about the taking of things prescribed. For through not taking disagreeable drinks, purgative or other, they sometimes die. What they have done never results in a confession, but the blame is thrown upon the physician.

The magnificent *Aphorisms*, which are next upon our list, are written in a style which was adapted by the medical schools from the philosophers for the advantages of its pithy, striking form and its aid to the memory. The *Sentences* of Cnidus, already referred to, were in this form. If the philosophic aphorism was tinged with poesy, the medical was a clear generalization of observed fact, as the examples (from Mr. W. H. S. Jones' new translation) which follow will show. The total number of the *Aphorisms* is four hundred and twelve.

From the First Section.

XIII. Old men endure fasting most easily, then men of middle age, youths very badly, and worst of all children, especially those of a liveliness greater than the ordinary.

XX. Do not disturb a patient either during or just after a crisis, and try no experiments, neither with purges nor with other irritants, but leave him alone.

From the Second Section.

II. When sleep puts an end to delirium it is a good sign.

V. Spontaneous weariness indicates disease.

VI. Those who, suffering from a painful affection of the body, for the most part are unconscious of the pains, are disordered in mind.

XXXI. When a convalescent has a good appetite without improving his bodily condition it is a bad sign.

XXXVIII. Food or drink which, though slightly inferior, is more palatable, is preferable to that which is superior but less palatable.

XXXIX. Old men generally have less illness than young men, but such complaints as become chronic in old men generally last until death.

XLIV. Those who are constitutionally very fat are more apt to die quickly [have less power to resist severe disease than those who are thin].

From the Third Section.

IX. It is in autumn that diseases are most acute and, in general, most deadly; spring is most healthy and least deadly.

XIV. All diseases occur at all seasons, but some diseases are more apt to occur and to be aggravated at certain seasons.

XVIII. As for the seasons, in spring and early summer children and young people enjoy the greatest well-being and good health; in summer and part of autumn, the aged; for the remainder of autumn and in winter, the middle-aged.

From the Fourth Section.

XXIV. A dysentery beginning with black bile is mortal.

XXXVII. Cold sweats, occurring with high fever, indicate death; with a milder fever they indicate a protracted disease.

LXVI. In acute fevers, convulsions and violent pains in the bowels are a bad sign.

LXXIX. When the urine contains a sandy sediment there is a stone in the bladder.

From the Fifth Section.

II. A convulsion supervening upon a wound is deadly [i.e. tetanus].

III. Convulsion or hiccough, supervening on a copious flux of blood, is a bad sign.

PLATE XIX

The Greek Idea of the Ideal Physician

There is no authentic portrait of Hippocratès, but in many grave-featured busts of the Father of Medicine a more or less common ideal is traceable, due perhaps to the profound impression made by Hippocrates upon his contemporaries. This fine bust is Greek work of the 3rd or 2nd century B.C.

British Museum.

Plate XIX

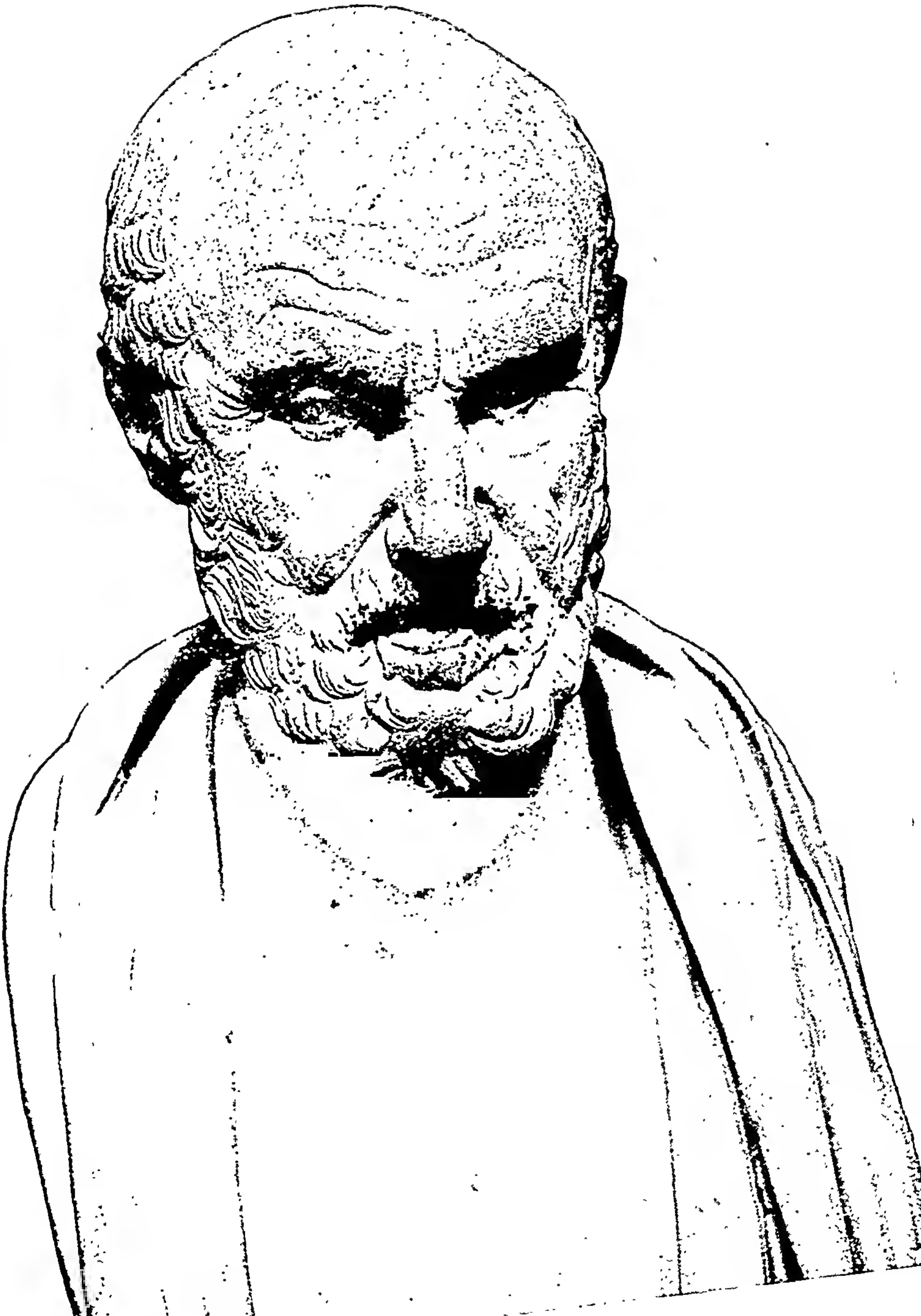


PLATE XX

PLATE XX

A Greek Clinic at the End of the Fifth Century

The patients waiting their turn, seen in this vase painting of about 400 B.C., are, in order, a man with a bandaged chest: an achondroplasic dwarf: a man with a bandaged left leg: a patient being cupped (bled) by the physician: a man seated with a bandaged arm, and a fifth smelling a flower, perhaps to ward off infection.

From E. Pottier, in "Monuments Piot".

IX. Consumption occurs chiefly between the ages of eighteen and thirty-five.

XIII. When patients spit up frothy blood, the discharge comes from the lungs.

From the Sixth Section.

VI. Kidney troubles, and affections of the bladder, are cured with difficulty when the patient is aged.

LI. Those who when in health are suddenly seized with pains in the head, becoming forthwith dumb and breathing stertorously, die within seven days unless fever comes on. [Apoplectic seizure.]

LIV. In acute affections attended with fever, moaning respiration is a bad sign.

From the Seventh Section.

I. In acute diseases chill of the extremities is a bad sign.

XI. Pneumonia supervening on pleurisy is bad. [Alternative reading: Pneumonia often supervenes on pleurisy.]

LVIII. In cases of concussion of the brain from any cause, the patients, of necessity, lose at once the power of speech.

LXVI. If you give to a fever patient the same food as you would to a healthy person, it is strength to the healthy but disease to the sick.

LXXXIII. When in illnesses tears flow voluntarily from the eyes, it is a good sign, when involuntarily a bad sign.

It would be an insult to the reader's intelligence to do more than emphasize the ever-living sanity and what we, somewhat impertinently, call modernity, of these notes from the Master Physician's case books.

The two remaining books of the Hippocratic Canon need only to be referred to briefly. We have noted that *Airs, Waters, Places* is the first book ever written on climatology and the hygiene of places. Greek physicians were travellers and a book like this would give them valuable information concerning medical conditions of a strange town and the type of disease likely to be met with there. This purpose is clearly stated in the opening paragraphs of the book:

> Whoever wishes to pursue properly the science of medicine must proceed thus. First he ought to consider what effects each season of the year can produce; for the seasons are not at all alike, but differ widely both in themselves and in their changes.
>
> The next point is the hot winds and the cold, especially those that are universal, but also those that are peculiar to each particular region.

He must also consider the properties of the waters; for as these differ in taste and in weight, so the property of each is far different from that of any other.

Therefore, on arriving at a town with which he is unfamiliar, a physician should examine its position with respect to the winds and to the risings of the sun. For a northern, a southern, an eastern, and a western aspect has each its own individual property.

He must consider with the greatest care both these things and how the natives are off for water, whether they use marshy, soft waters, or such as are hard and come from rocky heights, or brackish and harsh. The soil, too, whether bare and dry or wooded and watered, hollow and hot or high and cold. The mode of life also of the inhabitants that is pleasing to them, whether they are heavy drinkers, taking lunch [i.e. taking more than one full meal a day], and inactive, or athletic, industrious, eating much and drinking little.

Using this evidence he must examine the several problems that arise. For if a physician know these things well, by preference all of them, but at any rate most, he will not, on arrival at a town with which he is unfamiliar, be ignorant of the local diseases, or make blunders, as is likely to be the case if he have not this knowledge before he considers his several problems. As time and the year passes he will be able to tell what epidemic diseases will attack the city, either in summer or in winter, as well as those peculiar to the individual which are likely to occur through change in mode of life.

The careful attention paid to public hygiene is evidenced in the study of water supply.

I wish now to treat of waters, those that bring disease or very good health, and of the ill or good that is likely to arise from water. For the influence of water upon health is very great. Such as are marshy, standing and stagnant must in summer be hot, thick and stinking, because there is no outflow; and as fresh rain-water is always flowing in and the sun heats them, they must be of bad colour, unhealthy and bilious. Such waters I hold to be absolutely bad.

The next worst will be those whose springs are from rocks—for they must be hard—or from earth where there are hot waters, or iron is to be found, or copper, or silver, or gold, or sulphur, or alum, or bitumen, or soda. For all these result from the violence of the heat. So from such earth good waters cannot come, but hard, heating waters, difficult to pass and causing constipation.

The best are those that flow from high places and earthy hills. By themselves they are sweet and clear, and the wine they can stand is but little. In winter they are warm, in summer cold. They would naturally be so, coming from very deep springs.

The last book, entitled *The Sacred Disease*, is an elaborate discussion of the causes and nature of epilepsy and other brain seizures. Its characteristic is its sanity and its main theme the

uniformity of nature as opposed to the popular dualistic view which regarded some happenings as being natural and others divine. We quote the opening words:

> I am about to discuss the disease called "sacred."
>
> It is not, in my opinion, any more divine or more sacred than other diseases, but has a natural cause, and its supposed divine origin is due to men's inexperience, and to their wonder at its peculiar character. Now while men continue to believe in its divine origin because they are at a loss to understand it, they really disprove its divinity by the facile method of healing which they adopt, consisting as it does of purifications and incantations. But if it is to be considered divine just because it is wonderful, there will be not one sacred disease but many, for I will show that other diseases are no less wonderful and portentous, and yet nobody considers them sacred.

We have contrived to lay before the reader but the smallest fractions of these great and original works. Nevertheless, even these fragmentary specimens should suffice to convince him that the claims put forward for this thought and this science surviving from the youth of our modern world have not been overstated. Let him but contrast these medical and hygienic achievements of the fifth century B.C. with those of Assyria and Egypt of the seventh century B.C. and realize how utterly impossible it is to conceive that in those two centuries, or ten times those two centuries, the Eastern peoples should have advanced from their dimly lit superstitions and conservatisms to the blazing daylight of the West.

CHAPTER VI

INHERITORS OF HIPPOCRATES: ALEXANDRIA AND ROME TO A.D. 200

WITH THE passing of the Hippocratic school commonsense and the scientific spirit seem at once to weaken, and the clear and serene air of the fifth century medical world is in the centuries that immediately follow filled with the dust and clamour of sectarian disputation and charlatanism. The change is not quite so great and complete, however, as perhaps it seems, the truth being that sophistry and quackery were then, as in all other ages, always present and flourishing. In our long view backwards through twenty-five centuries they are temporarily overshadowed by the greatness of the Hippocratic figure. Were we able with our knowledge to go back to the fifth century we should be surprised to find how little the fame of the great man and his colleagues bulked in the daily talk of the market-place, how loud mouthed were his critics and detractors, and what a roaring trade was done by voluble quacks of all grades, including many doing lip reverence to the Master and his divine patron. So, futile though much of it seems, we must not be surprised at the apparent flood of sophistic writings that now follow nor at the way in which arid philosophic doctrines re-assert over true medicine that dominance from which Hippocrates had rescued it. Man never remains for long keyed up to the highest pitch; always the strings are let down again, the notes become less clear and true.

Nevertheless the next centuries present much matter of scientific merit and many advances are made. We shall take advantage of the point of view of this study—the stream of progressive ideas—to pass lightly over the dull details of sophistic futilities and to concentrate on the few greater figures.

In the fourth century arises the genuinely colossal figure of Aristotle, an Asklepiad and the son of an Asklepiad, Nicomachus, who was physician to the father of Philip of Macedon. He not only took all knowledge for his province—was he not "Master of them that know"?—but in every branch of knowledge pro-

duced original work. The ordinary school curriculum has tended to present Aristotle as a tedious and somewhat tyrannous dry-as-dust but the greatness of his intellect and the originality of his genius is such that to attempt an estimate here would be an impertinence. He gave medicine its real beginnings in botany, comparative anatomy, embryology and physiology. He was one of the greatest biologists and naturalists. His ideas determined the direction of medical thought and his philosophy governed all other thought for over two thousand years. Before the nineteenth century, at least, any proposition which could be shown to be "not according to Aristotle" was dismissed as unworthy of an intelligent man's consideration. As his influence on medicine was mainly biological we are not called upon to enter into detailed discussion of it here. His attitude is well seen in this sentence from his *Works*:

> But health and disease also claim the attention of the scientist and not merely of the physician in so far as an account of their causes is concerned.

Following Alcmæon, Pythagoras and other early theorists (see page 45) Aristotle held the doctrine of the four qualities and the four elements which, with the Hippocratic humours, remained the keystone of the medical arch for many centuries. Aristotle died in 322 B.C. shortly after his world-conquering pupil, Alexander.

Aristotle had done so much to systematize knowledge, as well as to originate it, that it is perhaps not impossible to sympathize with the vain efforts of the sectarians of the next four or five centuries to find a cast-iron system of medicine which should be capable of more or less mechanical application when once the initiated had learned its secrets. But all—Empiricists, Dogmatists, Methodists, Eclectics and others—to a greater or less degree sinned against the Hippocratic light in any such search.

To the Dogmatists the physician who was also a philosopher was godlike. Accordingly they indulged in immense speculations based upon the really small amount of theory in the Hippocratic works but afterwards pruned into a definite system by Galen who acknowledges himself a pupil of the Master. The Dogmatists, or Rationalists as they came to be called afterwards, at least recognized that progressive medicine must be based on physiology and not on mechanistic theories divorced from observation. Among them were included Diocles, who invented an

opium remedy for toothache, and declared that fever was not a disease in itself but a symptom, and Praxagoras, his disciple and successor as leader of the Dogmatists, who declared, says Galen, that there were eleven humours instead of the Hippocratic four.

The Empirics, who despised anatomy, though they derived from the school of Alexandria which was deservedly famous for its anatomical achievements, rejected this wholesale theorizing and insisted that it was not the cause but the cure of disease that was of moment and so reduced medicine to a rule-of-thumb treatment of classified sets of symptoms. That they deserved much of the scorn poured on them by Galen is clear, for their semi-experimental pharmacology and toxicology resolved itself into a search for specifics—drugs that of themselves would cure a particular disease or set of symptoms—that led to the extravagances in drug mixture that disfigure the pharmacy of two thousand years.

Empiricism found favour in high places. Mithridates, King of Pontus, who became an acknowledged expert in poisons, attempted to discover, on empirical lines, a universal antidote; whence we have mithridates and theriac, innumerable varieties of which were continuously produced and launched with marvellous claims by physician, chemist and quack up to the eighteenth century.

The brightest star in this school was Heraclides the Empiric (230 B.C.). He is exceptional, because he did not abuse his colleagues as did nearly all other medical writers of those and later days, he did not introduce "startling new remedies to excel the virtues of tortoise blood or crocodile dung" (*Withington*) and, unlike other Empirics, he paid respect to Hippocrates.

The wildest set of theories were those propounded by the Methodists which, on paper, are amusingly simple, both diagnosis and treatment nearly becoming mechanical. The Methōdists (note the long o) were a Græco-Roman school of the first century B.C. who attempted a middle way between Empirics and Dogmatists. Their ideas were that certain symptoms were common to many diseases, there being "communities" of symptoms, that in all diseases there was increase or decrease of secretion or excretion due to dilatation or constriction of the pores of the body and that treatment accordingly consisted of astringents or laxatives. Patients were so classified. Disease was an independent thing, to be judged apart from all individual peculiarities and defined and classed by its symptoms without

reference to cause. Like the Empirics they despised anatomy. Their leader, Themison of Laodicea, claimed to have reduced medicine to so simple a system that he had reversed the aphorism of Hippocrates with which our previous chapter began and made "the art short" while "life was long."

Speaking of the success of the Methodic practitioners in Rome Dr. E. T. Withington, in his *Medical History*, is probably not unjust to them, when he says that the causes of their success were not far to seek:

> Here was a theory suited by its connection with the dominant Epicurean doctrines to the philosophic Greek. Here was a rule of thumb which attracted the practical and methodic mind of the Roman. Above all, here was a short and easy system by which a self-confident individual might, with least preliminary labour, put money in his purse, label himself with an attractive name, and become a fashionable practitioner.
>
> The fact that so many Methodists were distinguished as "ladies' doctors" may indicate that the sex was particularly attracted by the new system. Celsus tells us that it was found useful in slave infirmaries and we may, perhaps, picture the Lady Bountiful of the period walking through such an institution, armed with the last pamphlet by Thessalus, and followed by a slave bearing the typical Methodic remedies, a bottle of leeches for all the "stricti" on one side of the ward, and a jar full of decoction of poppy-heads and honey—the famous diacodion of Themison—for all the "laxati" on the other.

The Eclectics were a general philosophical school of much less medical importance, for they were, mainly, dilettante compilers who are found in Rome from the first century A.D. onwards and did little for the progress of medicine. Galen himself has been included among them in the sense that he recognized and selected the best in all systems, but he refused to be identified with any school.

But before considering Galen and Rome we must turn back to glance at the line of development from Alexandria. When Alexander the Great conquered Egypt he founded one of his many selfname cities there in 331 B.C. Under the Ptolemy Dynasty (which came to an end with Cleopatra in 30 B.C.) Alexandria flourished as a centre of Greek learning. Ptolemy I established its museum, which grew into a great university and medical school with library, laboratories and clinics. Here the greatest men of ancient science studied and thought—Ptolemy the geographer, Euclid, Hero, Strabo, and many another; and in medicine at different times, Asclepiades,

Dioscorides, Soranus, Galen, were students. Its Great Library, a genuine wonder of the ancient world (there was a daughter library at the temple of Serapis), contained in 50 B.C., it is said, about 700,000 rolls of MSS. (many of them doubtless being replicas), including, without doubt, hundreds of masterpieces of classical antiquity, all now lost. Its precise fate is not known, but there is little doubt that neglect, repeated religious riots and the accidents of war resulted in its disappearance before the fourth century A.D.

Among the greater names in Alexandrian medicine were the anatomists Hierophilus and Erasistratus. Modern anatomy practically dates from the Alexandrians, but we cannot go into the details of their achievements. Of interest to our thesis are certain medical facts. Pliny says that Hierophilus was the first physician who searched into the causes of disease, and Pliny is so prejudiced a witness in the matter of Greek medicine that this may be taken as high testimony. Certainly Hierophilus was an acknowledged Hippocratist, a humorist, and he is said to have declared that the best physician was he who was able to distinguish between the possible and the impossible. He counted the pulse by the water-clock, and studied its rate and rhythm.

Erasistratus, whom Galen contemned so bitterly, wrote on the importance of hygiene in the prevention of disease and contrived a system which, rejecting the humours, filled the arteries with air or vital spirits and the veins with blood. This idea that the arteries contained air persisted for many centuries and was an important obstacle to the discovery of the circulation of the blood. Plethora of the veins was the general cause of inflammation, fever and disease. He disapproved, however, of bleeding (venesection) and his medicine consisted of mild laxatives, barley-water and wine in extremely small doses.

Hellenic medical culture in Alexandria was in general highly developed. Dietetics, materia medica, pathology, public baths, regulations for wet nursing, circumcision and embalming are all described in some detail in the great Oxyrhynchus papyrii which has been studied by Sudhoff. This culture, and the schools that developed from it, was, after Hippocrates himself, the main influence in medical development of the next five or six centuries, particularly in Rome, to which we now turn.

Actual Roman medicine was from the beginning up to the arrival of the despised Greeks in the second century B.C. a negligible affair. Of genuine Roman medicine there was at no

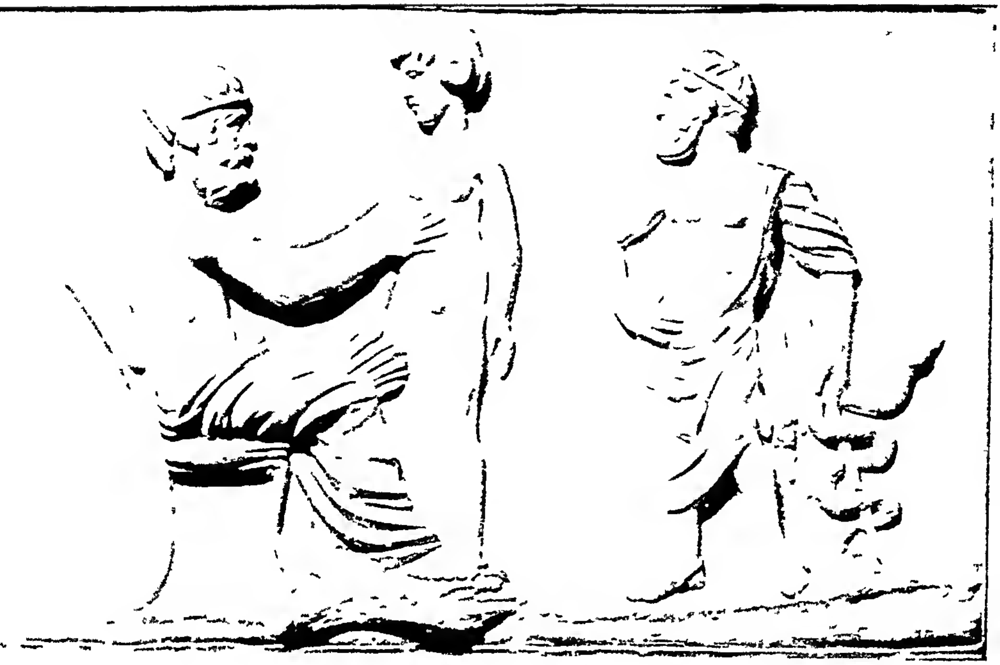
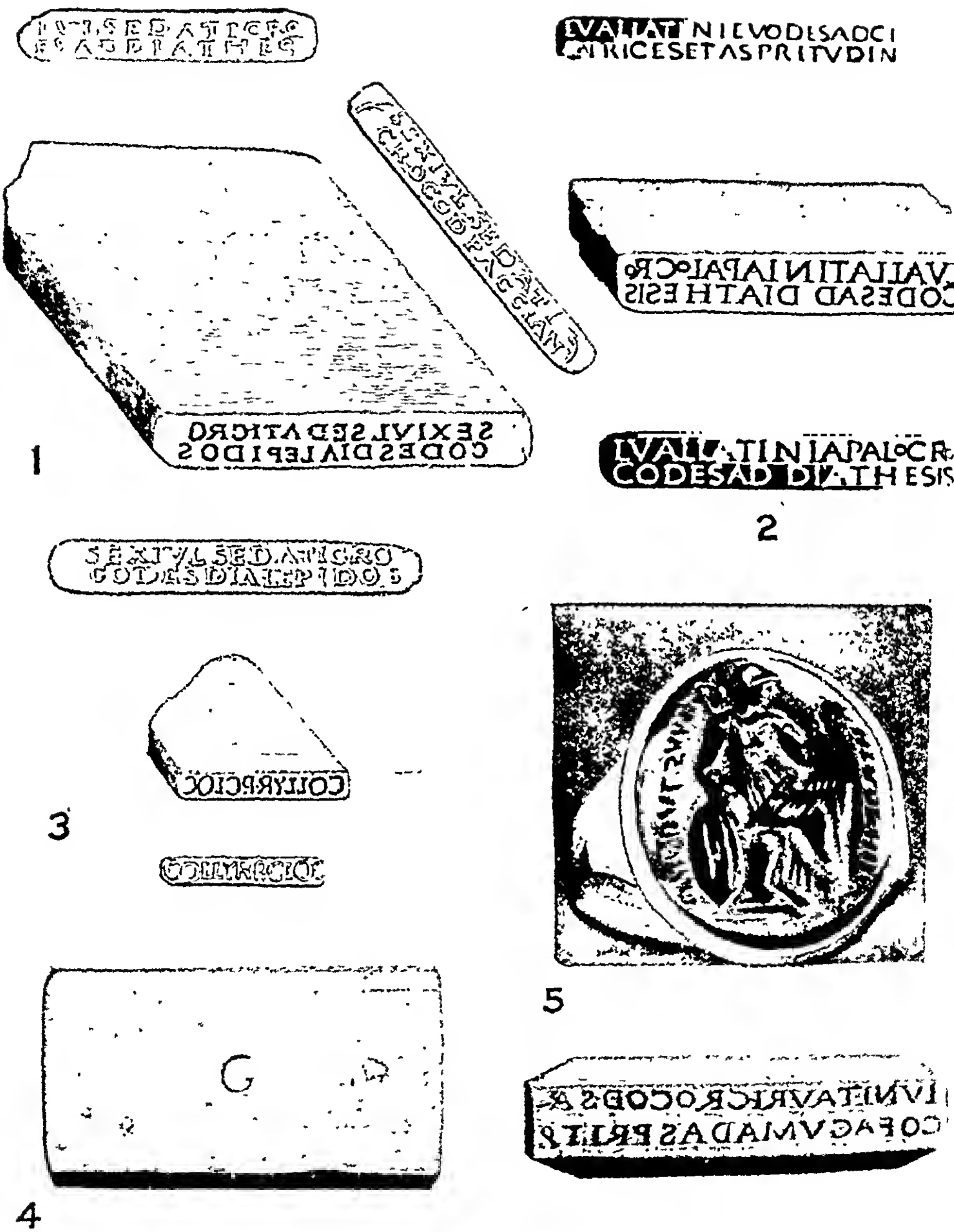


PLATE XXII



LVALLATINIEVODISADCI
CATRICESETASPRITVDIN
SEXIVLSEDATICRO
CODESDIALEPIDOS
1
LVALLATINIAPALOCR
CODESAD DIATHESIS
2
3
4
5

PLATE XXII

How the Oculist Quacks of Rome Stamped their Eye Salves

Large numbers of stamps with inscriptions in slate or steatite have been found on Roman sites in Europe. The engraved examples, 1–3 (from Sir James Young Simpson), are British. A photograph of another British example is seen below (4).

The inscriptions on the edges of the stamps gave the name of the oculist, his specific and its purpose, often in the nature of a puff. The inscription at the top of No. 2 may be translated as "the evodes of Lucius Vallantinus for cicatrices and granulations". The lower edge of the same stamp was used for his "mild crocodes for eye affections". Evodes, according to Scribonius Largus, was a complicated preparation including copper, myrrh, opium and other ingredients.

These eye-salves were sold in solid form to be dissolved in water and applied with a probe. The ring (5) was used for sealing packets of eye-salves: its gem is engraved with the figure of Athena and the title "Balsam of Herophilus", probably an obscure oculist of the first century B.C.

British Museum.

time anything of any account. That which was of substance was Greek or Græco-Roman. The Roman religious system forbade any scientific medicine. The early Latin, and even the later Roman of Republic and Empire, with his tinge of Etruscan gloom, was a hard headed yet superstitious person imbued with a complicated folk-lore. Every disease, every symptom in those early Latin times, had its minor deity, and these mainly malevolent spirits and powers had to be placated in a businesslike way. The chief of the family, the paterfamilias, supreme in his household, was his own physician, and there was no occasion for an external doctor. He kept a few simple herbal drugs in the store cupboard, the Penates, and these, with what amounted to magic, sufficed. "Up to the time of Cato," says Sir Clifford Allbutt, "the folk method was theurgy plus the drug."

Cato, the consul and censor (234–149 B.C.), was himself an excellent example of this type. He objected strongly to the Greek physic with which he was acquainted—probably nothing better than that of medical adventurers and charlatans—and maintained the health of his family and the slaves on his estates mainly by prescribing cabbage in various forms, wine and magic sentences. As Sir Clifford Allbutt in his lectures on Roman medicine remarks, the cabbage probably had virtue as an antiscorbutic in the absence of fresh meat in winter. Other prescriptions which he used appear to have come from a traditional book of recipes of which something is known from Pliny's *Natural History*. "Many were futile, many were filthy."

So Rome had no science, and, if the diatribes of Pliny are to be trusted, the older type of Roman, like Cato the austere Republican, objected vehemently to the introduction of Greek science, particularly Greek medicine. The first Greek doctors were slaves employed to treat gladiators and gymnasts and were generally mistrusted. In the second century B.C. Greek ideas began to be more readily absorbed in Rome.

Late in the first century B.C., however, we find Asclepiades of Bithynia a successful and fashionable physician in Rome, a man of culture who became the friend of Cicero. He therefore had the honour of effectively introducing Greek medicine to Rome (he went there about 90 B.C.). It is unfortunate that he did not introduce the Hippocratic doctrines. He is reported to have described the method of Hippocrates as "a meditation upon death," and that so far from curing Nature did as much

harm as good. He was a disciple of Erasistratus and also a follower of Democritus who first propounded what we moderns call the atomic theory. Applying this to the constitution of the body Asclepiades laid the foundations upon which, as we have seen, Themison afterwards built the Methodist School. A remark of his has the interest of curiosity. He said that the inhabitants of Britain (Cæsar had visited and described it in 54 B.C.) were long lived because the climate prevented the dissipation of the 'innate heat' of their bodies. A theory but poorly supported by observation!

It was about this time that the first decree conferring citizenship on all physicians practising in Rome was issued by Julius Cæsar, an elevation of practical value. Later emperors bestowed further favours since, apparently, the armies always needed physicians. Public medical officers were elected and approved by pro-consul or magistrate, but at no time was there any regulation of practitioners; quacks and charlatans abounded and were unhindered.

Republican Romans had no great respect for the medical profession; Cicero, who was consul in 63 B.C., considered it an occupation "not dishonourable for those whose rank in life it suited." The prejudice against Greek subtlety (the bluff Englishman's distaste for French 'fal-lals' was on an exactly similar basis) disappeared in Imperial days, and, if Pliny is to be trusted, some physicians became extremely wealthy. C. Stertinius Xenophon, physician to the Emperor Claudius, was paid an annual salary which might equal £10,000 in present-day value. Unfettered competition from every variety of practitioner, the larger number worthless and disreputable, meant, however, that for those without official position or fashionable following the profession was but a poor choice. Moreover most Romans of position owned their own medical slaves.

The variety of practitioners and hangers-on of the profession of medicine was, in Imperial days, really extraordinary. Almost anybody was a doctor (*medicus*); there were no qualifications beyond reputation. At the head were the *archiatri*, or chief physicians to the Emperors. Public physicians existed in most cities from the second century onwards, and there is record of their organization by districts in Rome as *archiatri populares* under Valentinian in the fourth century. Their duty was to the citizens, but there were many other public appointments, including the medical care of gladiators, the personnel of theatres, colleges, libraries, and professional associations, of

priests and the vestal virgins. After these and the smaller number in private practice there were the slave-physicians (*servi medici*). Those privately owned were slaves who had been given medical training; others were in the service of the State. Then follows a long list of specialists, many of whom can hardly be distinguished from the equally large class of quacks. Even the drug-vendors (*pharmacopolæ*), says Neuburger, dispensed pseudo-medical advice.

We hear in our own days talk of the evils of specialization; in Rome the half-educated and untrained man became a specialist, because it was the easiest method of setting up in practice by obtaining in a short time surface knowledge of a portion of a subject. An epigram of Martial describes the type:

> Cascellius removes or stops bad teeth, Hyginus burns away eyelashes which irritate the eyes, Fannius removes enlarged uvulæ without cutting, Eros eradicates brand marks from the skins of slaves.

The largest class of all were the eye specialists (*ocularii*), some of whom were undoubtedly men of esteem but many of whom were illiterate vendors of eye salves and lotions whom Martial bitterly satirizes in the following epigrams (VIII, 9 and 74) which have been translated by a friend of the writer:

To Quinctus—Oculist.

While Hylas was merely blear-eyed he'd have paid fifteen bob
in the pound:
He cuts down the fifteen to ten now that he's blind in one eye.
Take what you can while you can; there is naught so elusive as
money;
If he loses the sight of the other you may kiss the last shilling
good bye.

To a Bad Doctor

Oculist once, you now enjoy
A gladiator's fame;
Yet unchanged methods you employ,
And kill men just the same.

These ocularii seem to have vied with each other in the production of new eye salves which were sold in tablet form stamped with the maker's name and a puff of his specific. Over two hundred oculists' stamps, engraved in slate or steatite for this purpose, have been found on European sites [Plate 22]. High-sounding titles, sometimes combined with bad spelling, are given to these quack salves, as "Monohemeron" ('a one-day

cure'). Galen thought so little of these gentry that he considered it useless to write of eye diseases scientifically for, he said, the oculists would not understand him. Oculists of the better class held official and military appointments, one even, as Withington notes, being styled "Oculist to the British Navy!"—an appointment to the Roman fleet in British waters.

So the stage is set for the entry of the last great figure in the medicine of antiquity—Claudius Galen, whose name means "the peaceable," but whose life was noisy strife, who before he was twenty-one had written a text book for midwives, a book on eye diseases, three on the lungs and a polemic; who, though he was inferior to his master Hippocrates, knew all that his world had of knowledge; who wrote five hundred lengthy treatises on every subject, and by his systemization of medicine, anatomy, physiology and disease gave to the world "the law" in these departments which none gainsaid effectively for twelve hundred years. If he ended, as he did, by becoming the dead hand in medicine of medieval times that was due to medieval mentality rather than to the doctrines of this "bonny fighter."

Born in A.D. 131 at Pergamos, in Asia Minor, a medical centre of renown with a library only second to Alexandria, Galen studied the chief philosophies of his day, and at seventeen turned to medicine, both his philosophical and his medical studies being eclectic in the general and better sense of the term. In A.D. 162 he arrives in busy, factious, Rome. Antoninus Pius died the year before. Marcus Aurelius is emperor.

There he finds active the four principal schools of medicine whose doctrines we have noted earlier; active in practice and in propaganda of their doctrines, the commonest method being vicious backbiting and strident abuse of rivals. The calm detached Hippocratic atmosphere with its dignified professional ethic is lost. Even Galen, brilliant figure though he be as practitioner and anatomist, is no exception. At no time does he attempt to conceal his contempt for his colleagues or the leaders of the sects. For instance, in one of his best works, *On the Natural Faculties*, after refuting to his complete satisfaction the atomistic doctrines of Epicurus (the great Stoic philosopher) and Asclepiades (the physician) he begins a fresh chapter thus:

> We have talked sufficient nonsense not willingly but because we were forced, as the proverb says, "to behave madly among madmen." . . . Let us forget the absurdities of Asclepiades.

PLATE XXIII

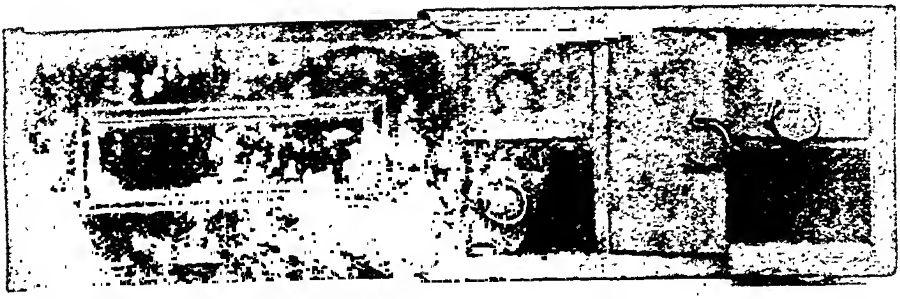
The Roman Physician

The relief, from a sarcophagus found in Rome, and dating from about A.D. 100, shows a Græco-Roman physician at his desk. He reads a MS. taken from a cabinet, on top of which is a case of surgical instruments. For a discussion of the relief see Petersen, König, Deutsch. Archaeol, Inst., Rome, 1900, Band 15.

Copyright, Wellcome Historical Medical Museum.

The metal drug case below is divided into separate compartments each with its cover and a sliding lid over the whole. It is of the second or third century A.D. and came from Asia Minor. Other examples of Roman physicians' outfits of this date have also been discovered in Asia Minor.

British Museum.



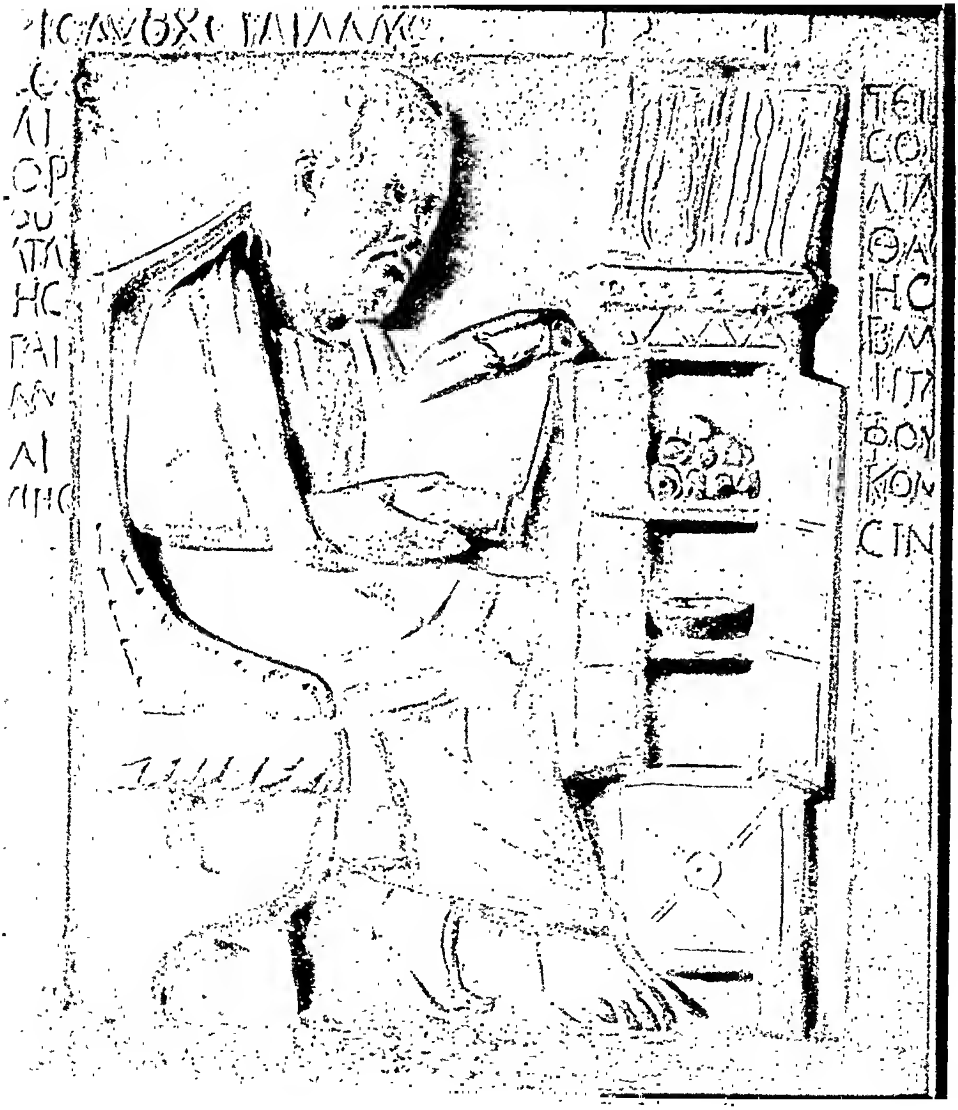


Plate XXIV

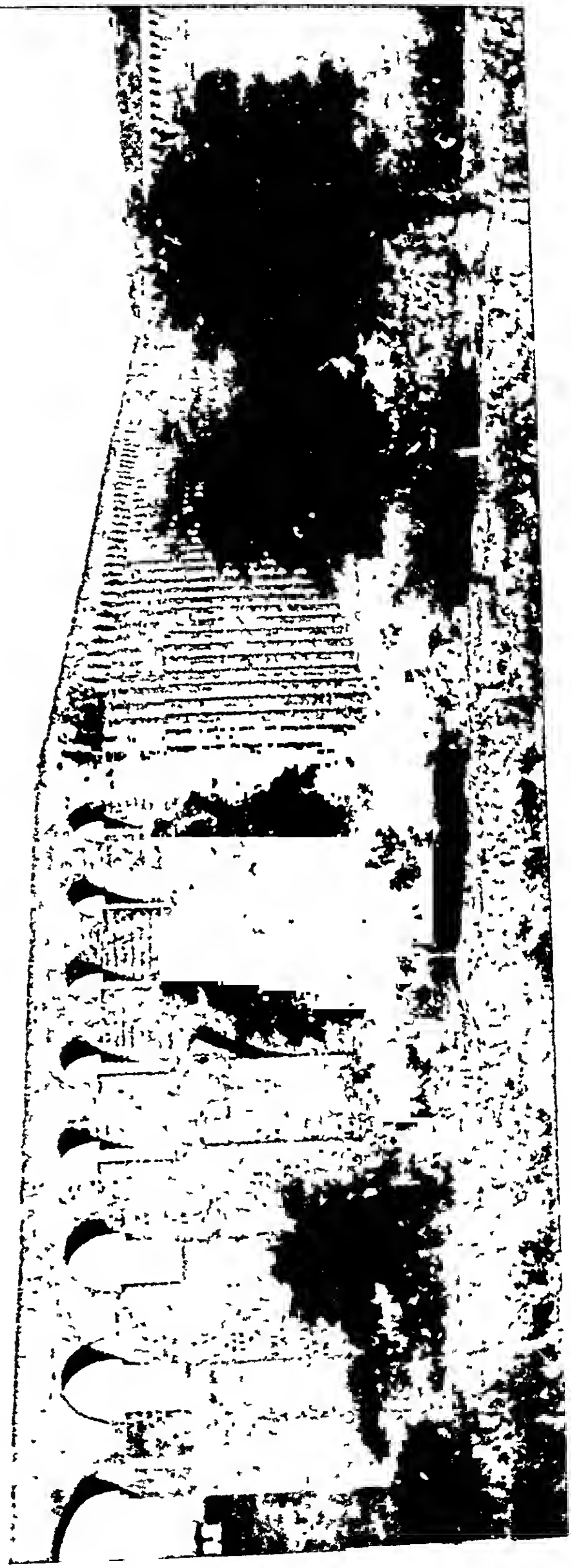


PLATE XXIV

MONUMENTS OF ROMAN PUBLIC HYGIENE

In the absence of cheap and reliable metal for pipes, the expert water engineers of Rome fell back upon the plentiful stone and other similar local materials with which they constructed their aqueducts, many of which still exist. The upper example, at Tunis, was built by Hadrian to bring water to Carthage from the mountains. The Aqua Claudia (below) was one of the nine which supplied Rome in Hadrian's day, seven of which were constructed before it was built in A.D. 38. It brought water from the springs of Tivoli and stretched, as the photograph shows, far across the Campagna. On top of it a row of brick arches, the remains of which can still be seen, carried yet another aqueduct, the Anio Novus, which was the ninth. Two more aqueducts were built in later reigns, and the total supply is estimated at about forty million gallons per day. The poor fetched their supply from the public fountains while the wealthy had it brought to their houses in lead pipes (*see* next Plate) stamped with their names. It is estimated the supply averaged about forty gallons per person, but this included the vast bathing establishments.

From " Wonders of the Past," Amalgamated Press, Ltd.

Again when he is discussing the Hippocratic view of the functions of the kidneys he cannot, he says, keep silence.

> For I know that if one passes over the Hippocratic view and makes some other pronouncement . . . one cannot fail to make oneself ridiculous. It was for this reason that Erasistratus kept silence and Asclepiades lied; they are like slaves who have had plenty to say in the early part of their career and have managed by excessive rascality to escape frequent accusations, but who, later, when caught in the act of thieving, cannot find any excuse.—(*Dr. A. J. Brock's translations.*)

And he really had (and showed elsewhere) genuine respect for both these men; he but reflects the spirit and tone of his day. Nevertheless he knew the limitations of the party man. Speaking of the disputations of "our present-day Asclepiadeans" he remarks:

> So difficult an evil to get rid of is this sectarian partisanship, so excessively resistant to all cleansing processes, harder to heal than any itch!

Let us turn to his actual and lasting merits.

Of the five hundred treatises one hundred and eighty-one have survived, of which about one hundred are accepted as genuine. Many of his medical works were destroyed, as he tells us, in a fire about ten years before his death which consumed his *Apotheke* (drug-store) on the Sacred Way. In sheer volume of writing he leads the ancient world, and though its literary quality is unequal, many of his treatises being written in highly polished Greek and others but outlines never filled in, he presents, in a system which he intended to be universal, a complete synthesis of Greek and Græco-Roman medicine and allied sciences. He was much more than a compiler or systematizer, however, as his clever experimental work in anatomy and physiology showed. His medicine and pathology were based on the Hippocratic humours, and his own theory of the temperaments and worked up by arrangement of all the possible combinations into a system which—on paper—was finely logical. "No phenomenon was without a name, no problem without a solution."—(*Allbutt.*) Later ages accepted it only too completely. Its authority was not to be challenged, the inspiration of its written word a matter of dogma and its interpretation and application to unfortunate patients but a question of dialectic.

His ideals as a physician are exposed in his treatise *The Best Physician is also a Philosopher*, a maxim we have already met as the motto of the Rationalist or Dogmatic sect. The efficient healer is to be well grounded in "logic, how to think; physics, the science of what is, i.e. Nature; ethics, the science of what to do." The severe labours which are required of him in mastering his science, and in the actual study of disease in the living person, necessitate self-control of a high order and the ignoring of the life of pleasure. In the sick-room the physician is to avoid noise and to accommodate himself to the patient's level and to be tactful. Untimely and too frequent visits are condemned. The physician should assist Nature as Hippocrates taught, a saying to be fully understood only by the experienced practitioner who has seen how difficult it is, under certain circumstances and with the best intentions to avoid doing harm.

His conception of the doctor's duty towards the individual patient was imperfect for he did not accept the Hippocratic idea of medicine as "the art." Rather was it to be a philosophic system with theory of at least equal importance to observation. His contests with the sectarians, whose quarrels his system finally silenced, were in part resistance to their methods of attaching labels to diseases and treating the labels rather than the patients. Of the Empirics he says, they were "terrible fellows for names."

Undoubtedly Galen attached considerable importance to clinical observation. His method is in the main scientific; though it is obscured too often by the methods of the study, he is ready to test statement by experiment and observation. But never does he give us a clinical history such as we have from Hippocrates or such as is taken in every hospital in the world to-day. In this matter again the medieval physicians followed the wrong example. Galen's stories of his cases are always given to demonstrate his cleverness or the accuracy of his theory. A well-known episode recounted by Galen himself with much boasting affords an excellent example. When the Emperor Marcus Aurelius returned in A.D. 176 from one of his many campaigns against the German peoples of the Danube frontier of the Empire he fell ill with what the court physicians held to be a feverish paroxysm (an easy label of little meaning) and treated with purgatives. Galen was summoned and effected a cure which he describes as "really marvellous."

Three physicians had seen him in the morning and at the eighth hour, and two had felt his pulse, whilst to all did it appear the beginning of an attack. I, however, remained silent; then the Emperor, perceiving me, asked why I had not, like the others, felt his pulse. I replied: "Two have already done this, and from their experience upon the journey with thee are better able to judge of its present condition."

As I said this he called on me to feel him, and as the pulse, taking into consideration the age and constitution of the patient, seemed to me inconsistent with an attack of fever, I declared that none was to be feared, but that the stomach was overloaded with nourishment which had been coated with phlegm.

This diagnosis called forth his praise and he thrice repeated: "Yes, that is it, it is exactly as thou sayest; I feel that cold food is disagreeing with me." He then asked me what was to be done.

I answered him frankly that if another than he had been the patient I should, following my custom, have given him wine with pepper. "With sovereigns like thyself, however, physicians are in the habit of employing the least drastic remedies, therefore it must suffice to apply wool saturated with warm spikenard upon the abdomen."

The emperor replied that warm ointment on purple wool was his usual remedy for pain in the stomach, and called Peitholaos to apply it and let me go. This being done and his feet warmed by rubbing with heated hands, he demanded Sabine wine, threw pepper into it and drank, after which he said to Peitholaos that now at last he had a physician and a courageous one, repeating that I was the first of physicians and the only philosopher; he had tried many, not only the covetous but those greedy of fame and honour and those filled with envy and malice.

As I have just stated this is the most remarkable diagnosis I have made. . . .—(*Neuburger.*)

It is clearly impossible to make any kind of survey here of the Galenic writings; their bulk forbids and their wordiness makes effective quotation impracticable. His best written work is considered to be the treatise *De Locis Affectis* ("On the Parts Affected by Disease") as it is one of his most important. Here he takes the individual parts and organs of the body in order and describes their symptoms and signs in disease and provides definitions of real insight which in general, discarding his fine drawn distinctions, agree with many in modern acceptance. Disease is "an abnormal affection of the body giving rise to a morbid change in function."

Harmonious mixture of the humours is the ideal state of health—"eucrasia". Disease which affects the body generally or any of the four humours is "dyscrasia". Predominance of any of the humours gives rise to a "temperament"—sanguine, phlegmatic, bilious or melancholic. He recognizes a causal

theory which is, in effect, entirely modern, dividing the causes of disease into three—exciting, predisposing, and immediate. This recognition of predisposition to disease as shown by temperament and physical constitution was a pathological advance of great importance. The morbid processes as a whole are grouped as diathesis. Symptoms are "morbid affections dependent and necessarily following upon diseases, as the shadow follows the substance."

In his therapeutics Galen's doctrines and practice are a curious mixture of the sensible and the extravagant. In spite of his duty paid at the Hippocratic shrine he propounded and practised much that interfered with the course of Nature. "Though he did treat fevers by tepid baths, he was heavily pharmaceutical; too disposed to forget his physiological and pathological methods in a search for specifics and thus to accumulate recipe medicine." —(*Allbutt.*) Undoubtedly he added extravagantly to the number of drugs already in use and did not disguise that he was, to some extent, satisfying the popular demand for "something in a bottle" (*Populus remedia cupit*). Later writers dubbed him the Father of Pharmacy (whence "galenicals"), but in this department he was largely a compiler. Certainly the influence of his materia medica was great and long lasting.

The sensible aspect is well displayed in the doctrine of the indications—"whatever enables us to draw conclusions concerning treatment apart from experience." From this we still have the special medical use of the word "indicate"—to suggest or call for a particular form of treatment. The main Galenic indications for treatment are:

(1) *indicatio morbi*, dependent upon character, type, and intensity of the disease;
(2) *indicatio symptomatica*, demanding treatment by lessening pain, regulating evacuations, etc., by contrary, if against Nature, and by similar if in accordance with Nature;
(3) *indicatio vitalis*, dangerous condition to be averted.

To these were added indications or contra-indications from the patient himself—temperament, age, strength, residence—from the season, the atmosphere and—an Asklepian echo—the patient's dreams.

Finally, it may be said that as a therapeutist he paid close attention to dietetics, gymnastics, massage, and the use of baths in great variety—water, sun, sand, minerals and herbs all being employed in his balneo-therapy.

It is not appropriate to our scheme to discuss the excellent

PLATE XXV

Roman Achievement in Drains and Plumbing

In both these matters the modern world has not greatly surpassed Roman methods. The lead water-pipes (note the remains of a wiped joint) were found under the floor of the house of Livia on the Palatine Hill, Rome. The Cloaca Maxima, Rome's oldest and longest sewer, may well be, says Professor Bosanquet, the work of Etruscan engineers. It is a great paved and vaulted tunnel which runs past the Imperial Forums into the Tiber, a distance of, roughly, a mile. Its exit into the Tiber is seen in the photograph. The lower portion has never been out of order, but medieval neglect resulted in the upper stretches being choked until they were cleared in the late nineteenth century. At least two other great sewers existed, now buried deep beneath the modern city. Many other Roman cities had equally excellent sewers.

From "The Universal History of the World," Amalgamated Press, Ltd.; photos, Donald McLeish and Alinari.

Plate XXVI

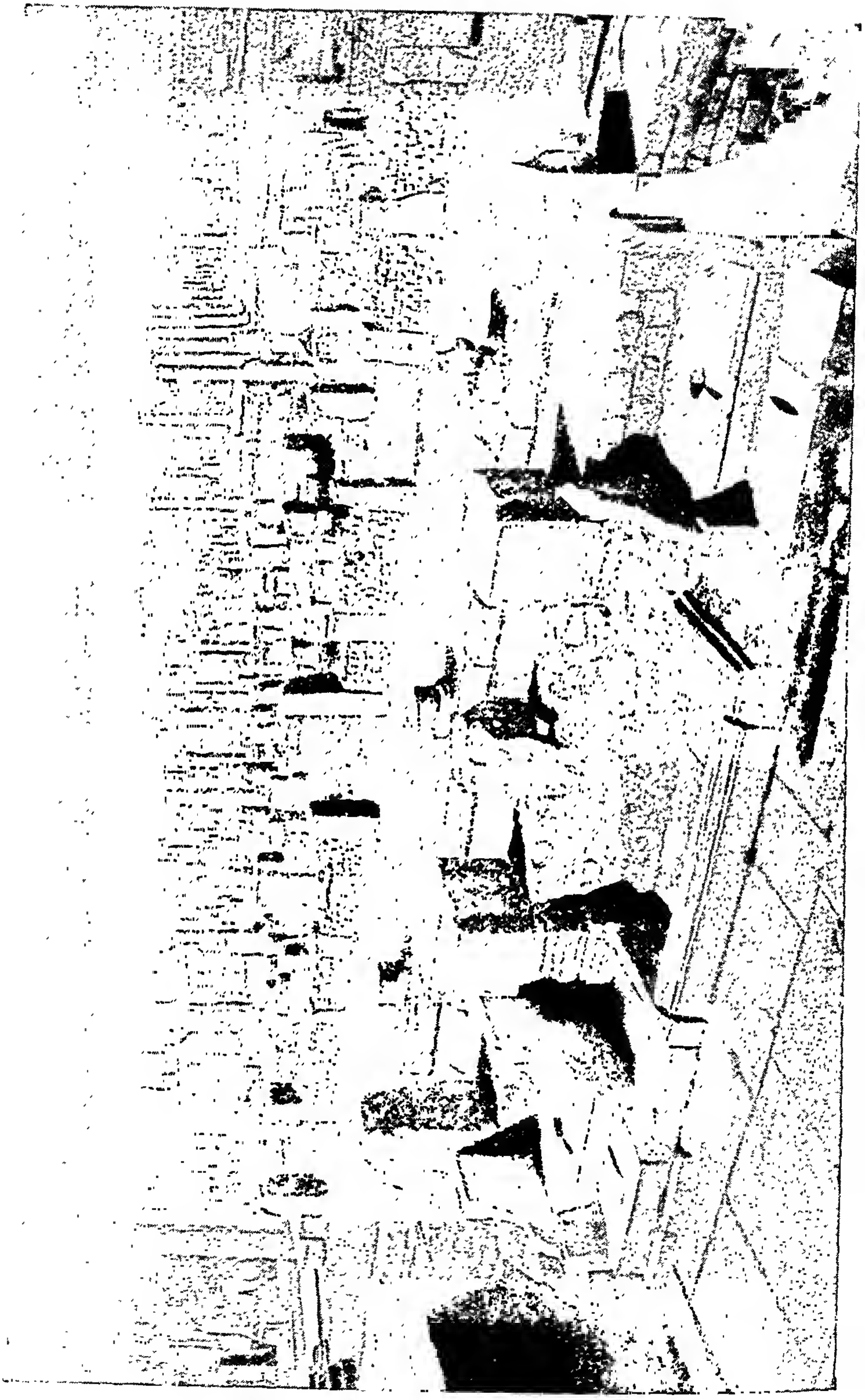


PLATE XXVI

Sanitation in a Roman Colonial City

The ruins of Timgad, which are one of the great tourist sights of N. Africa, include extremely well-ordered hygienic and sanitary installations. In addition to fifteen public bath establishments there were finely appointed public lavatories, a portion of one of which, placed near the Forum, is seen in the photograph. It had twenty-six carved stone seats, each enclosed by stone dolphins, and its drains were kept constantly flushed by a fountain in the centre. Timgad was laid out as a colony by Trajan early in the second century A.D.

From "Wonders of the Past," Amalgamated Press, Ltd.

anatomy (excellent though based on animal dissection) and interesting and highly important physiology of the last of the ancients, but one item in his physiology is worthy of note, since it concerns a subject to which we shall return in the seventeenth century. The quotation is taken from Dr. E. T. Withington.

> In opposition to his predecessors he declared that respiration serves not only to cool the body but to maintain the animal heat and made the happy suggestion that when we discover what part of the atmosphere supports combustion we shall also know what is the source of the bodily temperature.

It is a remarkable fact that no one had sufficient vision to follow up this inspired guess until our own John Mayow (1645–79) recognized the existence of this substance concerned with combustion and respiration.

It was Galen's philosophy, partly derived from Aristotle, that not only won a way in his own time for his essentially scholastic system, but gained him pre-eminence in later ages. His attitude that every part of the body, every physiological process was designed by superior—divine—intelligence to serve its particular end was one which made it possible for medieval theology, whether Christian or Islamic, to accept and absorb his teachings. The philosophers call it teleology—the doctrine of final causes—but its classification is of less importance than the fact that it avoided the offence to orthodoxy which was offered by the pagan and more scientific Hippocrates.

Summing up, we may say in the words of the historian of Greek medicine in Rome:

> If in later ages Galen's really great qualities and important discoveries were enormously inflated, even to infallibility, yet after all he was the greatest master of the scientific method from the second century to Roger Bacon.

Before we leave the Roman world something must be said of the excellent system of hygiene and hospital for in this, as in the theory and practice of medicine, the Middle Ages register a catacysmal decline.

The primal hygienic need of great cities, water, was amazingly well served in Rome and the cities of the Empire. Fourteen great aqueducts, ten of which were built by A.D. 110, supplied the capital with some 40,000,000 gallons of drinking water daily (estimates vary widely, a conservative recent calculation giving 1,540,000 gallons for the four principal aqueducts). The supply was proportionately in excess of that provided by any modern city. Professor Bosanquet says that "it was not until

the late nineteenth century that English cities began to construct aqueducts comparable with those of the Roman Empire." Almost every private house had its main service pipe with cisterns and taps. Settling tanks and other purification methods were employed on a large scale. The plumbing reached a high degree of excellence as surviving specimens of the jointed pipes show [Plate 25]. Vitruvius even pointed out the disadvantages of lead pipes for water, relating their use to the diseases suffered by lead workers, thus partially anticipating the discovery of Sir George Baker in the eighteenth century (see page 192). Galen had a similar idea for he particularly directs that in making up a certain medicine water flowing through a lead pipe is to be avoided.

Of Roman drainage we have a still visible token in the great Cloaca Maxima which, constructed in the earliest days of Rome remains, more than twenty-four centuries later, part of the city's sewerage [Plate 25]. Both in scale and engineering efficiency the Roman drainage system was in advance of the Greek. The Maxima and two other cloacæ in Rome were really vaulted canals through which boats could pass as they did when Agrippa explored the whole system prior to repair a few years B.C. These cloacæ dealt with surface water as well as sewage, a method common, but objectionable, in European cities until quite recent times. In Rome large quantities of water regularly flowing from the many huge baths and the constant street fountains avoided insanitary results. The Tiber received it all. Even frontier posts were provided with well-planned drainage, as for instance at the mile-castle at Housesteads on Hadrian's Wall in Northumbria, where excavation has disclosed latrines flushed by surface water and storage tanks.

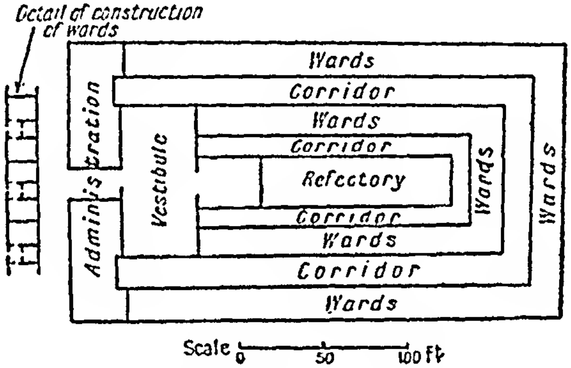
Though in its most important aspects the Roman hospital system was an organization that grew out of military needs it claims attention for its efficiency and success. Some have declared that the hospital is a Roman or even a late Christian invention. When one recalls, not only the chain of health temples of Egypt but the complexity and development of the Asklepian temples of Epidaurus and Cos and the variety of services they performed, surgical as well as medical, in addition to the religious, it is clear that the hospital idea is older than Rome. The hospital system or organization, however, as we conceive it is undoubtedly Roman.

In Rome and in Pompeii a number of institutions, known as *valetudinaria*, existed from late Republican times. Often considered to be primarily for the treatment of slaves (as was the

temple of Aesculapius on an island in the River Tiber) there is sufficient literary evidence to show that they were hospitals, often of considerable size, open to the wealthy as well as to the poor and in part supported out of public funds. One at Pompeii was in the nature of a nursing home run by a private physician.

The military medical service is clearer in all its details than the civil. Cohort and legion had their appointed surgeons and medical officers clad in military uniform as we see on Trajan's Column; they ranked as under officers.

The long campaigns in far countries required and obtained much more elaborate organization as we find from the time of Augustus Cæsar (27 B.C.–A.D. 14) onwards. In the permanent camps hospitals for sick and wounded were built. At Carnuntum (near Vienna), at Novæsium (near Dusseldorf), at Vindonissa (between the rivers Reuss and Aar), in Spain and elsewhere



Roman Hospital at Novæsium

clear remains of hospitals have been uncovered. Novæsium, on the Roman road to Cologne, was a fortress camp established by Tiberius. Its hospital (see plan) was well arranged with about forty sick wards arranged round long corridors, with a refectory in the centre, and administration buildings, medical staff kitchens, orderlies, apothecary's shop, etc.,—at one end. Evidently expense was not spared in the medical care of the army.

And then progress stops. All the splendid and apparently enduring culture of Greece and Rome, both material and intellectual, is destroyed or broken in the flooding Barbarian incursions and theological hatred of everything pagan and Western Europe sinks into mental sluggishness and darkness. Much survived, hidden and unknown to the West, in close-walled Byzantium and some escaped to the East, to return again as we shall see, through the good offices of Arab scholars.

CHAPTER VII

A THOUSAND YEARS OF DARKNESS: EUROPE, A.D. 200–1200

WHERE the Barbarian came he made a wilderness; chaos and ruin were his sign marks, but it is not to be supposed that the mental and material gloom of the Dark Ages was any sudden occurrence. Goth and Visigoth did but destroy in two centuries or so what was already decaying and had the heroic efforts of Diocletian and his successors stemmed permanently, instead of temporarily, the invading floods the death of the Roman polity would probably have been but delayed. The growth of the seeds of corruption was already too evident before the first massed attacks of Goth and Alemanni in the third century on the western frontiers of the Empire.

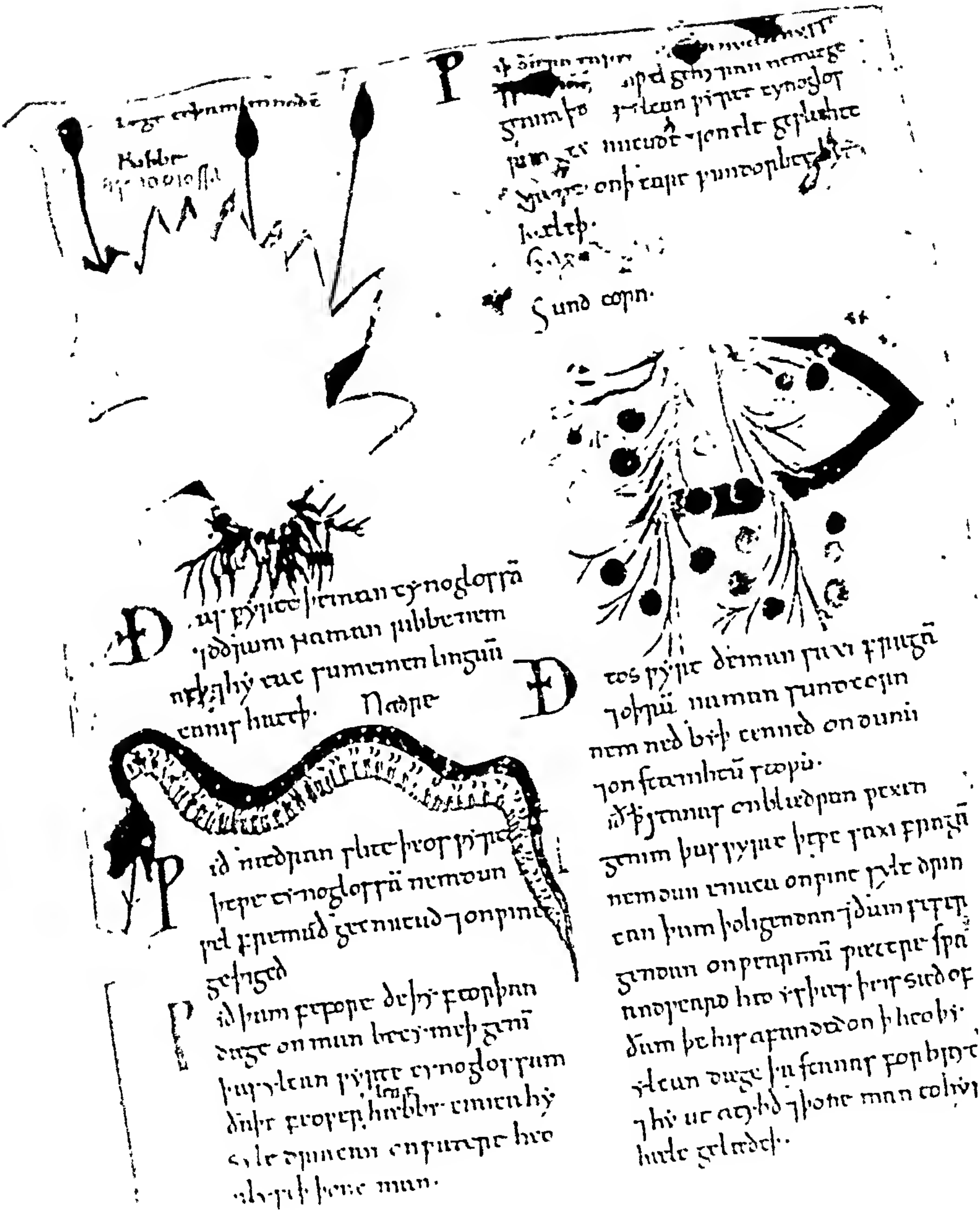
In medicine, as we have already seen, the decline towards the final fall had begun. After Galen we meet none but compilers and quacks. Original thought makes no considerable appearance and only a few names stand out. Oribasius, physician to that Emperor Julian, called the Apostate, who so cherished pagan learning and religion, compiled his *Medical Collection* in seventy-two books which are mainly of value for the extracts they give of earlier works otherwise lost. He is the last medical writer of importance of the ancient world. Afterwards cast out by the Christian Emperor Valens he became a favoured physician of the Visigoths. Two compilers of the early Christian period may be noticed in this brief survey. The Byzantine Ætius quotes largely from Galen and Oribasius, and is notable for long and elaborate prescriptions with theologic directions amounting to superstition. His *Tetrabiblos* was written in Greek in the mid-sixth century. Paulus Ægineta produced another voluminous epitome about 660 which, says Daremberg, "is without originality and equally drawn for the greater part from Oribasius and Galen," though mention of the fact is characteristically omitted. His sixth book on surgery, however, was superior to the rest of his writings. All these authors were for some time credited with greater originality than is their due.

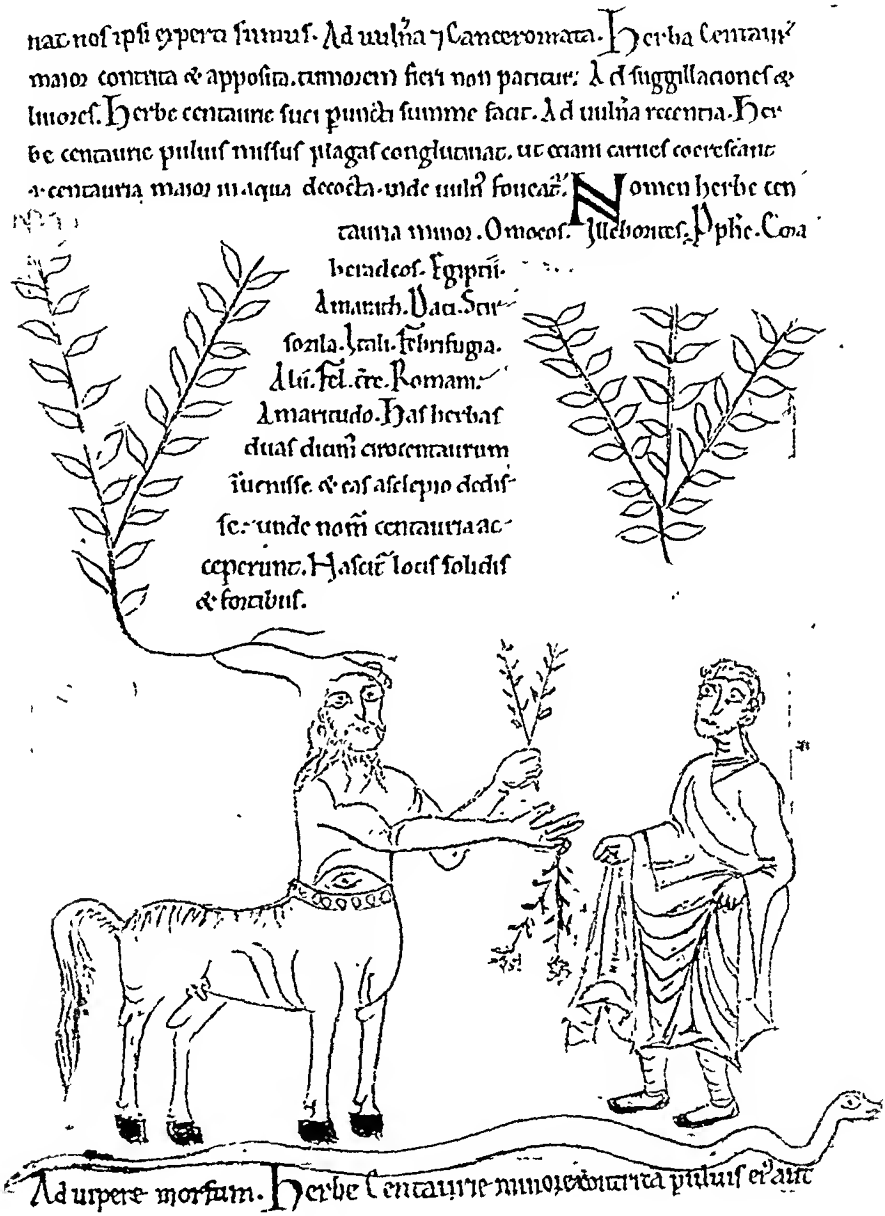
PLATE XXVII

Page from an Anglo-Saxon "Leechdom" of the Eleventh Century

Most of the surviving Saxon Medical MSS. are Christianised versions of an immensely popular Latin original, the "Herbarium" of Apuleius Barbarus. This particular leaf, from a well-illuminated MS. (MS. Vitellius C. III, dating *c.* 1050), gives recipes for treating snake bites, quartan ague, deafness and stones in the bladder. It includes the inevitable worm (*see* Plates XXVIII and XXIX). The hole in the left-hand corner of the leaf was caused by fire in Sir Richard Cotton's library in 1731 where this and many another MS. of the greatest value were originally collected. The plant on the right is, according to the text, a "wort, which is named saxifrage and by another name sundcorn, is produced on Downs and in stony places". It "leadeth to health" when "stones wax in the bladder."

British Museum.





nat nos ipsi experti sumus. Ad uulnera et Canceromata. Herba Centaurie
maior contrita & apposita. tumorem fieri non patitur: Ad suggillationes &
liuores. Herbe centaurie suci puncti summe facit. Ad uulnera recentia. Her
be centaurie puluis missus plagas conglutinat. ut etiam carnes coerescant
a. centaurea maior in aqua decocta. unde uulnus foueatur. Nomen herbe cen
tauria minor. Omoeos. Illebontes. Prophete. Con
heracleos. Egyptii.
Amarich. Daci. Sen
fozila. Itali. Febrifugia.
Alii. Fel. terre. Romani.
Amaritudo. Has herbas
duas dicunt chironcentaurum
inuenisse. & eas asclepio dedis
se: unde nomen centauria ac
ceperunt. Nascitur locis solidis
& fontibus.

Ad uipere morsum. Herbe Centaurie minoris contrita puluis ei aut

PLATE XXVIII

Herbal Magic in a Late Anglo-Saxon MS.

The twelfth century MS. of a Herbal (Harleian 5294), from which the drawings in this and the following Plate are taken, present characteristic ideas of the Dark Ages. It shows the fabled centaur, the man-headed horse, Chiron, who in Greek legend was first to discover the healing virtues of herbs. The centaur is offering a herb called centaury (but not the modern plant) to a physician. Below, the worm who appears largely in Teutonic notions of disease, flees from the magic herb.

British Museum.

Alexander of Tralles, a contemporary of Ætius at the court of Byzantium, may be quoted as an example of the way in which Greek medicine was finally submerged in superstition. He was a genuine eclectic, and his twelve books summarizing the Galenic pathology contain a refreshing amount of observation and judgement. The style is lofty and he recognizes the foolishness of treating the disease instead of the patient. Yet he gives the usual lengthy prescriptions and recommends charms and amulets of the most absurd description and variety. The following examples are taken from Withington:

> An amulet for quartan ague which I have proved by many experiments. Take a live dung beetle, put him in a red rag and hang him round the patient's neck.
>
> A green lizard together with the patient's nail parings may be used instead of the beetle.
>
> For epilepsy take a nail of a wrecked ship, make it into a bracelet and set therein the bone of a stag's heart taken from its body whilst alive; put it on the left arm; you will be astonished at the result.

So by the seventh century the last traces of active medicine have vanished, even in the home of Greek culture, Byzantium itself. Elsewhere it disappears much earlier. But half a century after Constantine had promulgated in 324 his famous Edict of toleration for all religions and "doxies" in the Empire, Theodosius decreed that paganism and Christianity could not exist side by side. Pagan rites were prohibited and pagan temples destroyed. Among them were inevitably the temples of Æsculapius where the incubation rites, described in an earlier page, were dangerously successful in their cures wrought in competition with the miracles effected by the saints and their relics. In Alexandria itself an archbishop in A.D. 391 led a crowd of fanatics to the destruction of the temple and library of Serapis. Everywhere throughout the Empire paganism saw its shrines broken up and their revenues confiscated; it bowed to the storm and conformed. It is a curious commentary that the votive offerings of limbs and diseased organs that had decorated the Æsculapian temples re-appeared dedicated in the churches and that the dream miracles of Saints Cosmas and Damian in the sixth and seventh centuries reflect closely the rites and usages of the "incubation" sleep of Æsculapius. According to the chroniclers of the miracles the two saints passed through the rows of patients sleeping in the church at Cyrrhos, where their bones were preserved, healing and giving advice for treatment.

In ancient Egypt magic killed both religion and science. Without stressing a parallel we find that medieval religion though not responsible for the initial decline of medicine—a decline which we have traced back to the century following Hippocrates himself—was yet a force which hastened the decline and would have completed its destruction had it not been for certain heretics and heathen.

From the early centuries of the Christian era we see the revival of those primitive theories of disease which have been discussed in earlier chapters. Basil, Bishop of Cæsarea A.D. 360, insists that disease may be caused by divine purpose or, by divine permission, by the agency of demons, and in such cases the physician is not to be called in, although the bishop himself declares medicine to be a noble profession.

A much more serious matter was an increasing restriction of freedom of thought and investigation. At the beginning and until the revival of thought which followed the beginning of the second millennium, the reasons are clear. "All medieval thought is characterized, nominally at least, by the conviction that each man has a soul to save, and that therefore salvation is the main end of every human being, not a distant ideal but the most practical duty," says Dr. Coulton, the learned medievalist. The Second Advent was never far beyond the horizon. "The world fabric might crash at any moment; what was the use of beginning a long chain of facts and inferences? . . . The painful lack of historical sense and of scientific observation or experiment during this long period" was partly due "to this predominantly other-worldly attitude of mind among many of the greatest thinkers." A consequence of this attitude is the concentration of intellectual effort upon theological controversy. Beginning with the speculation of the Greeks the habit of dialectic increased until in these troubled times it excludes all other thought and ranges from such amiable futilities as the number of angels dancing upon a needle point to fierce discussion of the constitution and attributes of the Godhead itself. The Byzantines were indefatigable in such dialectical exercises.

Ignorance, though not complete, was vast and widespread. All classical knowledge was at first contemned as pagan, and science and investigation of natural facts were, as Tertullian declared, unnecessary. Some ancient manuscripts were preserved in the monasteries, though many of these were used as material for writing devotional works, the old writing being scraped off. A certain proportion, however, survived all perils.

In the monasteries as in the outside world knowledge was scanty. It was necessary to decree in the seventh century that none should be raised to priest's orders unless he could read at least the Psalms and the order of baptism. Large numbers of monks were completely illiterate. Alfred, who re-established learning in England after the Danish invasions in the ninth century, bitterly lamented its decay. In the two previous centuries English scholarship and learning had been distinguished by such great names as Augustine, Theodore, the Greek Archbishop of Canterbury, the Venerable Bede, Boniface and others. At Alfred's accession there were, as he himself said, "few who could understand their service books in English or translate even a letter from Latin into English. . . . So few were there of them that I cannot remember even a single one south of the Thames when I succeeded to the kingdom."—(*R. W. Chambers.*) With the exception of the educational efforts of Charlemagne and the lamp of Greek learning that was kept burning, albeit somewhat dimly, in southern Italy, the general level in Europe was much below this before A.D. 1000. "All through the Middle Ages there was a great mass of lower parish clergy who, in fact, knew little more than their parishioners."—(*Coulton.*)

Although in practice the monks as part of their rule of charity relieved the sick and thereby played the part of physician, they were in general forbidden to do so. St. Bernard, the founder of the Cistercian order in the eleventh century, not only forbade his monks to practise or become students of medicine but also forbade them when sick to have anything to do with physic. "To buy drugs, to consult physicians, to take medicines, befits not religion." They must not use earthly remedies at the risk of salvation. Many of the legends of the saints present the same idea of the incompatibility of religious virtue and the treatment of disease by any means but prayer. On the other hand the huge Carolingian monastery at St. Gall included both a well-arranged hospital and a medicinal herb garden. There was undoubtedly much simple practice of simple medicine; as in other departments of life the monastic ideals were too austere for mortals of ordinary calibre.

We have chosen to attempt a brief note on the medieval background rather than to present strings of names of tedious writers and lengthy specimens of the futilities of medieval recipe books. It is obvious that if this attempt be a fair representation nothing in the way of medical science as we understand it could exist. In fact it did not—in Europe.

To show that the picture is not overdrawn and that the magic and superstition of the Assyrians do not suffer by comparison let us take a few examples from the well known "Anglo-Saxon Leechdoms," and other Saxon MSS. of the twelfth century and earlier, English documents which, as Dr. Singer states, "provide us with the best account of medical practice in the Dark Ages."

Not only are they valuable for this reason, but they also provide the opportunity to narrow somewhat the scope of our reading. From this point onwards where native material throws adequate light on the progress of medicine and hygiene we shall draw upon it in preference to Continental material.

These Saxon MSS. are in the main, christianized versions of Latin originals imperfectly translated from Apuleius Barbarus (his *Herbarium* appeared in multitudinous forms throughout medieval times), Dioscorides (the compiler of a great materia medica of authority unchallenged from the first to the fifteenth century) and others, with an admixture of Teutonic magic brought from the Saxon home-land. Some of these MSS. are beautifully illuminated. One in the British Museum, which is dated about 1050, contains hundreds of fine drawings of plants and animals freely copied from an Italian source, probably a late classical version of the *Apuleius* which it presents in duly modified form. Its frontispiece shows Chiron (the fabled centaur who first gathered simples) with Plato and Æsculapius both in Saxon dress. The figure labelled Plato is really, in the classical original form which the scribe copied, Apollo but he could not bring himself to do honour to a pagan deity. Another MS., which probably belonged to the Abbey of Glastonbury, was written about 950. It is an unillumined book of recipes and was translated and edited by Dr. Oswald Cockayne from whose work the following quotations are taken. The magic is simple in kind and simply accepted:

> Against mental vacancy and against folly; put into ale, bishopwort, lupins, betony, the southern or Italian fennel, nepte, water agrimony, cockle, marche; then let the man drink.

> Against a warty eruption, one must take seven little wafers, such as a man offereth with, and write these names on each wafer, Maximianus, Malchus, Iohannes, Martinianus, Dionysius, Constantinus, Serafion; then again one must sing the charm [not quoted here] first into the left ear, then into the right ear, then above the man's poll, then let one who is a maiden go to him and hang it upon his neck, do so for three days, it will soon be well with him.

PLATE XXIX

The Worm in Saxon Medicine

The most constant feature in the drawings of Saxon pseudo-medica. MS. is the worm (*see* also Plate XXVIII) who, as the cause of disease, came "to slay and to slaughter".

Ever he is to be defeated by magic, i.e. special herbs over which charms have been recited. This, one of the most primitive of all folk notions, is seen in the two drawings from Harleian MSS. 5294, where warriors, assisted by magic potions prepared by physicians, have slain worms and a scorpion, from whose bodies oozes the evil poison. The bulbous-rooted plant shown is labelled "Arnote", but it is not the earth-nut of the modern pharmacopœia.

British Museum.

data in muliere discutit uenenū.

Ad pc̄ussu ferro t' sude q se intice pcutiet. Herba Argimi cū aceto īposita pfectissime

Nomen herbe. Cyclaminos. Omoeos. Ceseron. Alii. Antion. Alii. Cassofillos. Alii. Chedonion. Zoroastres. Chaclena. Alii. Sumpaties. dicunt. Alii. Hostanes.

PLATE XXX

PLATE XXX

An Anglo-Norman Physician at His Patient's Bedside

This, one of a series of similar drawings from an Anglo-Norman MS. of the thirteenth century (Bodleian MSS., Ashmole 399), shows a physician who has pronounced, from examination of the patient's urine, that no hope remains. Urine inspection was throughout the medieval period regarded as the most important and reliable method of diagnosis. As noted in page 109 it lasted into the seventeenth century and the urine flask and urine charts were principal weapons in the doctor's armoury. Note that the physician is a layman, not an ecclesiastic.

Bodleian Library, Oxford; photograph by courtesy of Dr. Charles Singer.

For the better digestion of meat taken; take lupins, lay them under the altar, sing over them nine Masses, that shall avail for meat taken; lay it under the vessel into which thou hast in mind to milk.

If wens at the heart pain a man, let a maiden go to a spring, which runs directly eastward, and ladle up a cup full, moving the cup with the stream, and let her or him sing over it the Creed and Paternoster, and then pour it into another vessel, and then ladle up some more, and again sing the Creed and the Paternoster, and so manage so as to have three cups full; do so for nine days, soon it will be well with the man.

Against a woman's chatter take at night, fasting, a root of radish; that day the chatter cannot harm thee.

The reverse case is also simply provided for:

In case a woman suddenly turn dumb, take pennyroyal and rub to dust, wind it up in wool, lay under the woman, it will soon be well with her.

The elements of Teutonic magic in these "leechdoms" are of considerable interest as well as of illustrative value. In serious cases of one type the priest is called in to assist the leech:

If horse or beast be elf-shot take seed of dock and Scotch wax. Let a priest sing twelve Masses over them and add holy water and then put that upon the horse or on what cattle soever it may be. Have the worts [herbs] always with thee.

The Saxon, according to Dr. Singer, held two main doctrines of disease. One was the existence of malicious elves who "shot" the darts of pain and disease into man and beast (whence elf-shot in the quotation) and another was the worm theory, a form of which we have already seen in ancient Mesopotamia. The worm was a terrifying creature who appears repeatedly in the MSS. illuminations [Plates 27, 28 and 29]. It presents a really extraordinary example of the persistence of primitive folk ideas in magic and medicines. Elves, worms and demons all produce disease in different varieties according to their nature and are to be dealt with by charm, exorcism, or as again in ancient medicine, by disgusting remedies to nauseate and drive them forth. Some mixtures are truly hideous and include animal excreta. These are milder examples:

For pricking sensation in the eye. Break to pieces a hound's head and bind it on. It healeth well.

For sore ears. Mix a bull's gall with honey and drop it in. Soon it will be well with them.

For devil sickness and apparitions. Give wolf's flesh sodden.

For sleep, lay a wolf's head under the pillow; the unhealthy shall thus sleep.

Much power of magic resided in the number nine. The excerpt from the Glastonbury leech-book above included a direction for nine Masses. In the curious *Lay of the Nine Healing Herbs* (Harleian MS. 585) this idea is the core of the magical attack on the worm and the venoms of disease. It includes references to Woden and other gods of Teutonic and Scandinavian mythology. Nine herbs are selected and chanted over separately and then this incarnation in verse form is made over the nine placed together:

These nine can march on
Gainst nine ugly poisons.
A worm sneaking came
To slay and to slaughter.

Then took up Woden
Nine wondrous twigs
He smote then the worm
Till it flew in nine bits.

Omitting a few lines it continues:

Now these nine worts [herbs] avail
Gainst nine exiles from glory [i.e. devils]
Gainst nine venoms and nine flying vile things [epidemic disease.]

The nine venoms are listed (red, stinking, white, watchet, yellow, green, wan livid, brown and purple—Dr. Singer equates the yellow venom with jaundice, the red with erysipelas, green with anaemia). Then the herbs are powdered, mingled with soap, apple juice, water, ashes, fennel and boiled. The directions continue:

foment with egg mixture, when the man puts on the salve, either before or after. Sing the charm [not quoted here] upon each of the worts; thrice before " he " works them up, and over the apple in like manner; and sing into the man's mouth and into both his ears the same magic song, and into the wound, before he applies the salve.—(*Cockayne's translation.*)

The 'he' in the directions is the magician. Some traces of earlier and sounder medicine struggle through the compost of

magic and drug mystery but they are vitiated. Prognostication, which in the Hippocratic regime was of real importance, appears in tenth and eleventh century MSS. in debased form. In one, Greek words used ignorantly and without understanding as charms are arranged around a diagram of the days of the moon. According to the day on which the patient fell sick so the diagram pretends to tell whether he will recover or not. Another, a kalendar prepared about 970 which belonged to Leofric, first Bishop of Exeter, shows combinations of figures and verses from which a patient's chances were to be calculated. The doctrine of the humours, always in the forefront of medieval medicine, comes through more clearly. One twelfth century (late Saxon) MS., at Cambridge, has a diagram showing four angels pouring the four humours out of angelic jars into a human body. Another MS. of the same century is, says Dr. Singer, the latest Anglo-Saxon medical text. It is written in a corrupt Anglo-Saxon mingled with Greek and Latin words which show it to be an adaptation of a Continental work, probably deriving from Salerno. It is called *Peri Didaxeon* (Greek, 'Of the Schools' of medicine). It tells how leechcraft was hidden and how it was sought out and presents the contemporary form of the humour doctrine:

> Apollo invented the healing of men with knives, Aesculapius medicines, and Hippocrates viewing of sicknesses [i.e. diagnosis].
> Then came Plato and Aristotle, who said that in the human body there be four humours, to wit, phlegm in the head, blood in the breast, red bile in the inwards [genital parts], and black bile in the gall bladder. Each rules in its own three months. From December 25 to March 25 phlegm waxes in the head. From then to June 25 blood waxes in the breast. From then to September 25 red bile waxes in the inwards; and from then to December 25 black bile waxes in the gall bladder. So it pleased the Lord to constitute the parts of man according to the four cardinal points.

Here we may leave English and "Dark Age" medicine. It deserves and requires no further comment. The Norman period brings no advance of worth and Saxon ideas hold sway into the thirteenth century. In the meantime there have been developments in the south better worth consideration.

Until the eleventh century the mainland of South Italy was nominally under Byzantine control and although the influence of the Langobard princes was Latin, Greek thought and Greek writings were not as entirely lost there as in the rest of Europe. On the Gulf of Pæstum there grew up in the beautifully and

healthily situated Langobard city of Salerno the first regular medical school in Europe. Standing alone for two or three centuries it achieved a fame which was, according to some writers, in excess of its real due. Certainly to have studied there between the ninth and twelfth centuries sufficed to make the reputation of any practitioner. Record exists of a Salernitan physician to the queen of Charles the Simple of France at the end of the ninth century. But it was in the eleventh and twelfth centuries that its fame as the *Civitas Hippocratica* (the Hippocratic city) spread over Europe as being an abode of learning and an asylum for the sick. Certainly it did set a higher standard medically than the rest of Europe but of real scholarship and advanced medical learning we find little evidence. Its outstanding characteristic was that it was a secular institution and, until rival schools were set up in the days of its eclipse at Montpellier, Paris, Bologna and Padua, the only one at which no clerical status was required for its students. Its pride was its open mindedness and its reliance on sick bed experience but as elsewhere the experience was not deeply founded and we see, as Sudhoff puts it, but "the modest beginnings of a general art of healing."

Still, judged by contemporary standards, its work was very good. There is little room for doubt that the examination of those aspiring to practise medicine, which was enacted in 1140 by Roger II of Sicily (in whose kingdom of Apulia Salerno was included), was to be undertaken by the officers of the Salerno school, so far at least as the mainland was concerned. This decree, the first of its kind in Europe, is of particular interest:

> Whosoever will henceforth practise medicine, let him present himself to our officials and judges to be examined by them; but if he presume of his own temerity, let him be imprisoned and all his goods be sold by auction. The object of this is to prevent the subjects of our kingdom incurring peril through the ignorance of physicians.

In the next century that great man, the Emperor Frederick II, Stupor Mundi—as his half-horrified contemporaries called him, for he was a sceptic, a modern in politics, a freethinker with something of modern scientific inquiry in his thought, and a spurner of ecclesiastical control in any form—this man decreed not only license from Salerno but curriculum of study:

PLATE XXXI

The Thirteenth Century Physician Receiving and Visiting Patients

Taken from the same MS. as that represented in Plate XXX, the upper of these two delightfully ingenuous drawings shows the doctor seated while four patients wait upon him, with head or other troubles, having paid their fees to the doctor's assistant, who is seen on the right with a purse in his hand. Below, the physician departs on horseback the while the patient's family hold up their hands in delighted amazement at his profound wisdom.

Bodleian Library, Oxford MS. Ashmole 399; photograph by courtesy of Dr. Charles Singer.

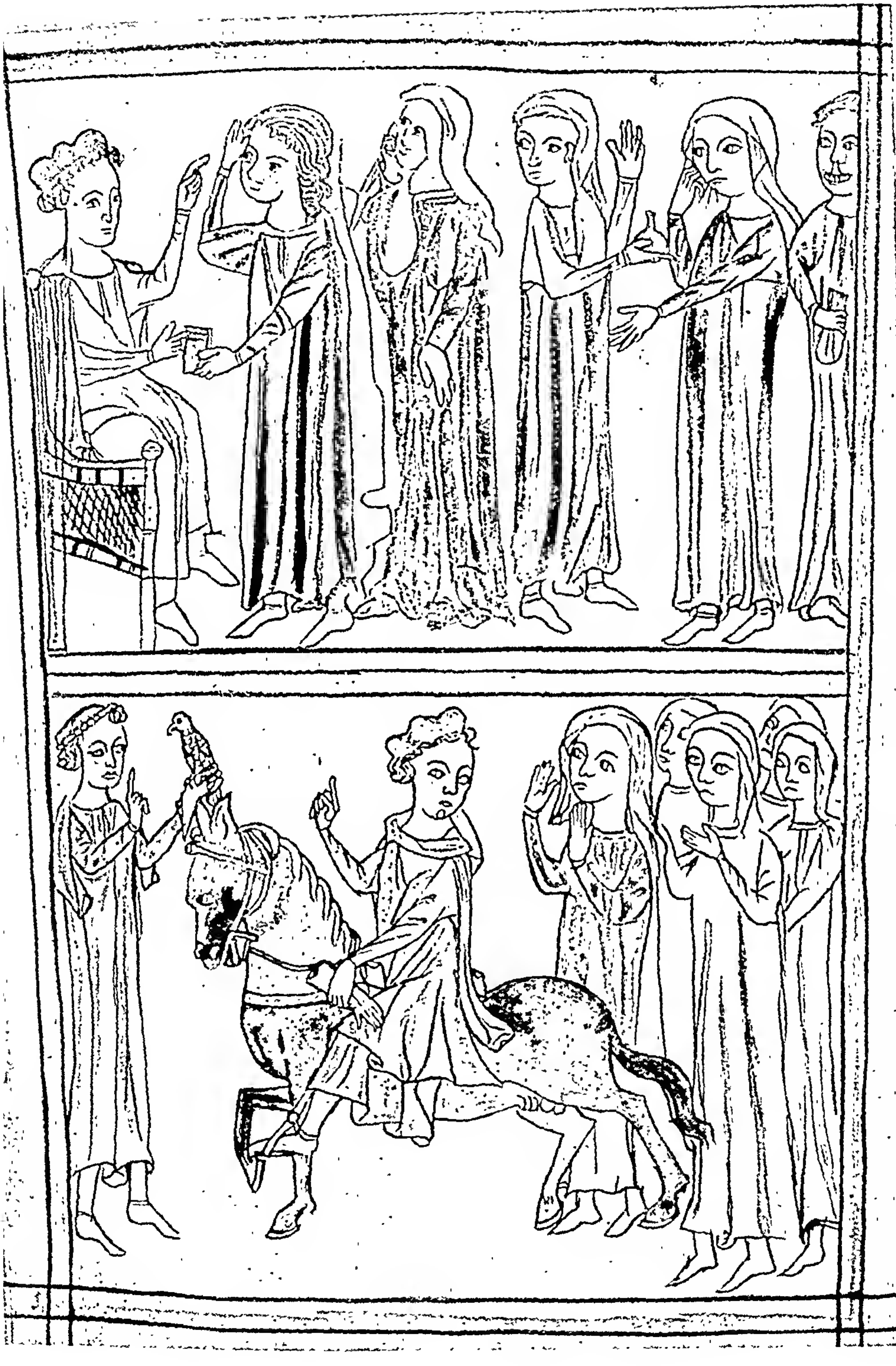


PLATE XXXII

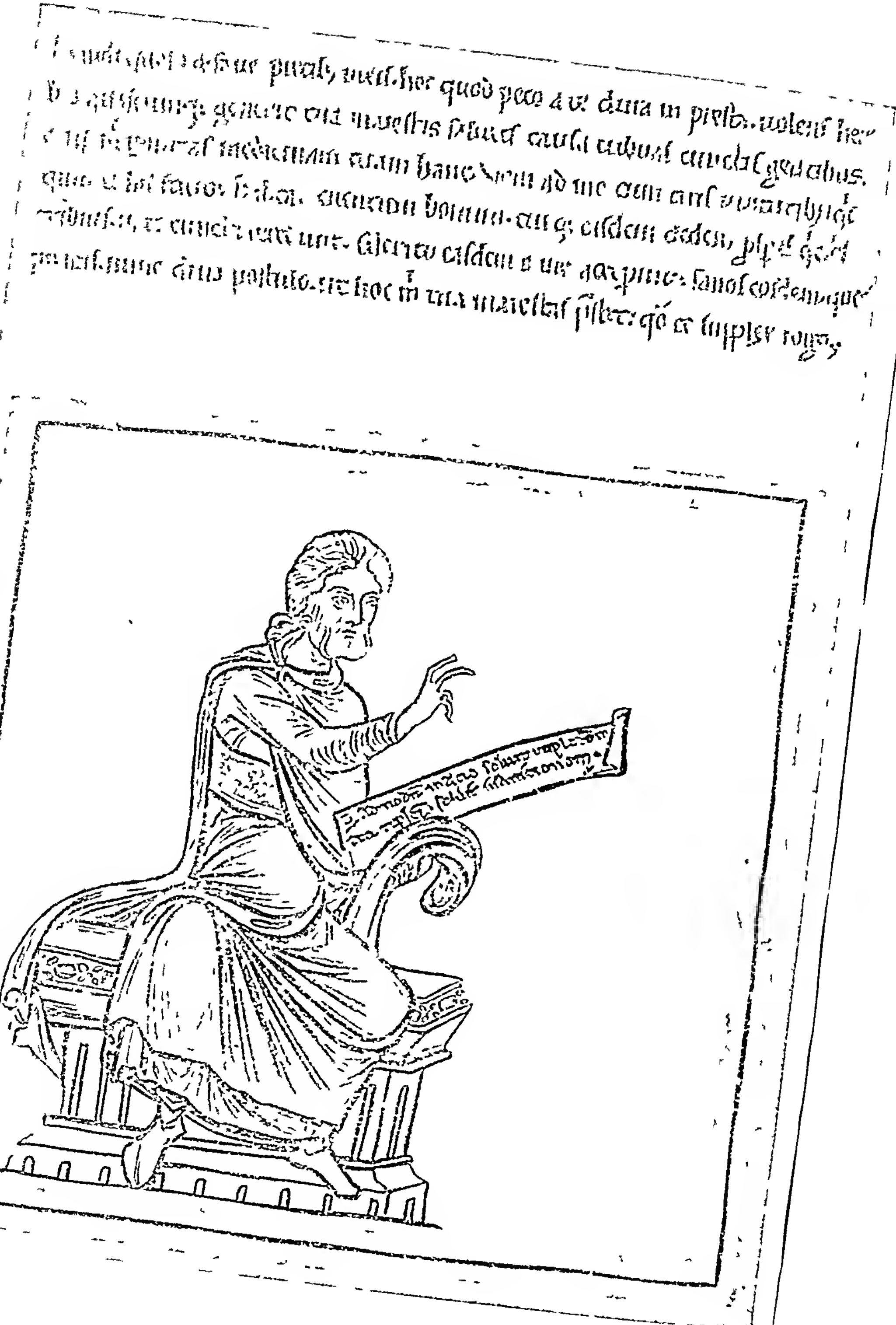


PLATE XXXII

Pagan Magic Practised in the Thirteenth Century

Saxon and Norman medical treatment depended in the main upon herb remedies. Of themselves they were too simple to be effective, and had to be reinforced by charms which, though often mingled with masses, were essentially pagan in character. In this thirteenth century illumination the physician (a layman, for he is not tonsured) is blessing the herbs. The prayer which he is uttering is entirely pagan, as the following partial translation shows:

> "Earth, divine goddess, Mother Nature, Guardian of gods, thou art called Great Mother of the gods; thou art Queen of gods. O goddess, whatsoever herbs thy power doth produce, give, I pray, with goodwill and grant them me as medicines. Howsoever I use them and to whomsoever I give them, may they have good success. I pray thee as a supliant that by thy majesty thou grant me this."

Harleian MSS. 1585, *British Museum.*

> Considering the harm which may arise from the ignorance of physicians, we ordain that no one shall henceforth practise physic unless he be first publicly examined by the masters at Salerno, and present testimonials, to ourselves or our representative, and receive from us or him licence to practise.

> Since the science of medicine can never be understood without some previous knowledge of logic, we decree that none shall study medicine unless he have studied logic for at least three years. Then let him learn medicine for five years, and also surgery, which is a part of medicine.

According to Dr. Withington (from whom the above translations are taken) it is to the masters of Salerno that the title "doctor" in the sense in which we use it, was first given by Gilles (Ægidius) of Corbeil about 1200.

About the end of the eleventh century appeared a pseudo-poetic work which did more than anything to spread the fame of Salerno. This, was the "Regimen Sanitatis" or "Schola Salernitana" which, written in verse form for easy copying by careless scribes, presents the body of popular medicine of that day. Whether it actually originated from Salerno or was one of the many medieval literary cheats, as Dr. Fielding Garrison thinks, is immaterial. Translated into many languages it spread over the whole Western world including the British Isles. By the middle of the nineteenth century no fewer than two hundred and forty editions of the poem had been printed, in addition to the many MS. copies, over one hundred of which survive in European libraries. Some of its bits of proverbial wisdom survive yet, as in the often quoted line from Longfellow:

> Joy, Temperance and Repose, slam the door on the doctor's nose
> (From the *Singgedichte of Friedrich von Logan*).

The Latin text (1491 edition) runs thus:

> Si tibi deficiant medici, medici tibi fiant
> Haec tria, mens laeta, requies, moderata diaeta.

Which may be translated:

> If you would do without doctors make your doctors
> these three:
> A Happy Mind, Rest and Moderate Diet.

Very matter of fact, and on the whole, sensible the verses deal with the forms of food which "be good to eat," herbs and their

healings, a few pains and their soothing, the seasons, many lines on the humours and temperaments with their appropriate forms of physick and lastly, the times and occasions for bleeding. In its simplicity and its tradition of authority lie the main reasons for the long lasting success of this regimen of health.

But more important than the appearance of these simple rhymes was the fact that a few years earlier, the conquest (in 1071) of Sicily and of the mainland, including Salerno, in 1077 by the Norman, Roger Guiscard, ended Byzantine rule and established real peace and order. With the conqueror there came to Salerno as interpreter of the Saracenic language, one Constantine, called the African. He brought with him a collection of Greek medical works in Arabic. These he turned into poor and incomplete Latin after he retired to the neighbouring monastery of Cassino.

Poor as his translations were they were of first importance, for they included not only several works of Arabian medical scholars, of which we shall hear something later, but also the *Aphorisms*, *Prognostic* and *Regimen in Acute Fevers* of Hippocrates and some books of Galen. He concealed the authorship of most of these books but they carried the first notions of Arabian medicine, and did much towards a revival of Greek physic. His works were studied until the late days of the Renaissance when accurate translations direct from the Greek first became available. It is worthy of note that we have to wait until 1532 for a Greek text of the *Aphorisms* when Rabelais, the satirist, humanist and physician, edited it.

From Salerno comes a delightful account of the medieval physician which we cannot forbear to quote. It occurs in a guide for the doctor called *De Adventu Medici* ("The Doctor's Visit") written about 1100 by Archimathaeus, a Salernitan master.—(Dr. Withington's translation from the Collection Salernitana.)

> When called to a patient commend yourself to God and to the angel who guided Tobias. On the way learn as much as possible from the messenger, so that if you discover nothing from the patient's pulse or water, you may still astonish him and gain his confidence by your knowledge of the case. On arrival ask the friends whether the patient has confessed, for if you bid him do so after the examination it will frighten him. Then sit down, take a drink, and praise the beauty of the country and the house, if they deserve it, or extol the liberality of the family.
>
> Next proceed to feel his pulse, remembering that it may be affected by your arrival, or, the patient being a miser, by his thinking

of the fee. [Minute directions for the examination of the urine follow.] Do not be in a hurry to give an opinion, for the friends will be more grateful for your judgment if they have to wait for it. Tell the patient you will cure him, with God's help, but inform his friends that the case is a most serious one.

Look not desirously on the man's wife, daughter, or handmaid, for this blinds the eyes of the physician, deprives him of the divine assistance, and disturbs the patient's mind.

If, according to custom, you are asked to dinner, do not hasten to take the first place, unless, as is usual for the priest and the physician, it is offered to you.

Often send to inquire how the patient is, that he may see you do not neglect him for the pleasures of the table, and on leaving, express your thanks for the attention shown you, for this will please him much.

Then come directions for treatment in simple cases, and finally the important question of the fee.

When the patient is nearly well, address the head of the family, or the sick man's nearest relative, thus: God Almighty having deigned by our aid to restore him whom you asked us to visit, we pray that He will maintain his health, and that you will now give us an honourable dismissal. Should any other member of your family desire our aid, we should, in grateful remembrance of our former dealings with you, leave all else and hurry to serve him.

Its mixture of simplicity and shrewdness make a fitting close to this part of our subject. In the next section, the Later Middle Ages, we consider the revivals in medicine due to the learning of Islam and the newly discovered learning of Greece and Rome in the Renaissance. The consideration (in brief) of medieval hygiene comes fittingly with that section.

CHAPTER VIII

THE DRY BONES STIR AND LEARNING AWAKES: A.D. 1200–1450

WE NOW begin to pick up again the threads of Greek science and medicine and remarkable beyond the primary fact of their preservation, are the wide journeyings necessary to pick them up. Up to the present our interests have been concentrated in comparatively narrow lands of Europe in one of which, at least, some not inconsiderable flavour of Greek physic lasted through even the Dark Ages. Now we follow the wanderings of Hippocratic, Aristotelian and Galenic learning through the Near East to Arabia and Persia, and on to distant Bokhara in Turkistan. Connections may even be traced in India and China.

When the civilization of the West finally collapsed into sordid ruin some copies of Greek works and some teachers of them survived. The means of these survivals were three. The most obvious one was the Greek empire of Byzantium but, as we have already indicated, theology and dialectic prevented it being more than a sterile storehouse of classical learning until its doors were flung open, somewhat rudely, at the fall of Constantinople in 1453. Then its precious collection of MSS. flowed freely into a Europe awakened and eager to profit by them. The least obvious was a heretical Christian sect, the Nestorians. The third, and most widely influential in the period now under review, were those great lovers of learning, the Arabs of the Eastern and Western Khalifates of the ninth to twelfth centuries.

It is a matter for reflection that if there was one incident more important than others that was responsible for keeping Greek medicine alive from the fifth to the fifteenth centuries it was an acrimonious theological dissension in the fifth century. Nestorius was bishop of Constantinople in 431, when a General Council of the Church excommunicated him, and deprived him of his see for his denial of the doctrine of Theotokos (that the Virgin Mary was the "Mother of God"). His condemnation and subsequent violent death led to the establishment of a new

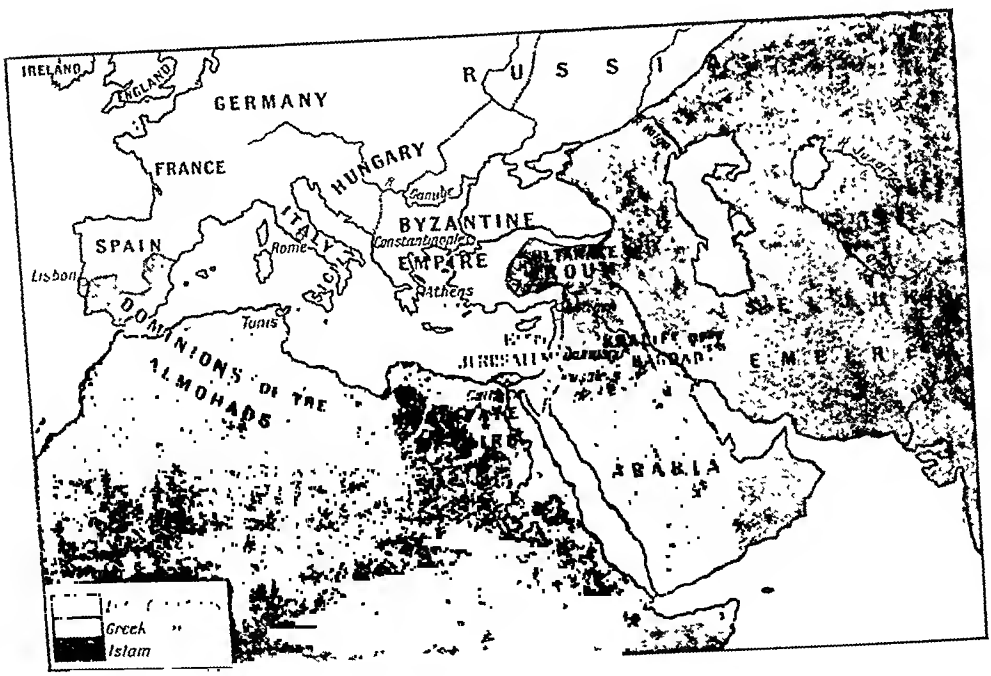
PLATE XXXIII

The First Revival of Medicine Through the Influence of the Arabs

The map shows the wide dominions of Islam in the middle of the twelfth century, and indicates thereby the strong influence of Moslem learning upon Europe. Arabic culture was then much more advanced than that of Christian Europe, and in medicine and science it held all that was known from the Classical Period. All the surviving medical works of Greece were translated into Arabic.

The picture above, which shows a consultation with an Arabian physician, occurs in a portion of an Arabic translation, dated 1222, of the great Materia Medica of the Greek Dioscorides.

Arabic painting from Dr. F. R. Martin, "Miniatures, Painters and Paintings of India, Persia and Turkey."


IRELAND
ENGLAND
GERMANY
FRANCE
HUNGARY
Danube
SPAIN
Lisbon
ITALY
Rome
SICILY
BYZANTINE
Constantinople
EMPIRE
Athens
Tunis
DOMINIONS OF THE
ALMOHADS
ARABIA
Greek
Islam

communion, the Nestorian Church which, under a Catholicus, the Patriarch of the East, flourished for a thousand years in Persia, Mesopotamia, and Syria, and even established bishoprics so far afield as Central Asia, India and China. Relics of the sect even survived to come under British protection in Iraq during the Great War. The importance of the Nestorians in our study rests upon their preservation of Greek learning at their great centre Edessa, in Mesopotamia, where they established a successful school of medicine with two hospitals. Within sixty years the heretics were expelled from the empire by the orthodox emperor Zeno and their college buildings destroyed. Re-established across the frontier at Nisibis they were afterwards welcomed by Noshirwan (Chosroes I) under whom Persia attained the zenith of her power and culture in the sixth century. At the great university which he founded at Jundeshapur, Greek learning which the Nestorians had brought was eagerly studied, with the addition of Indian philosophy and medicine. Jundeshapur became the most famous school of Mahomedan medicine and the fountain head of Arabic medical lore from the eighth century onwards, whence some part of the stream of Greek learning was once more to flow back to Europe. Had the Nestorians not carried Greek medicine to Persia it is difficult to see how Europe (apart from the limited activities of South Italy discussed in the previous chapter) could have acquired any considerable bulk of Greek medicine before the fifteenth century, for Europe knew but little Greek until the teachers from Constantinople travelled abroad after the siege of 1453.

In the seventh century the victorious banner of Islam swept over the whole of the Near East and into Europe, and the heritage of classical culture passed into the hands of the Khalifs of the East and the West at Baghdad and at Cordova, who carefully fostered knowledge. As Dr. Stanley Lane-Poole says, "No more astonishing movement in the history of civilization has occurred than the sudden passion of the whole Islamic world for culture. . . . This was the supreme service of Islam to general culture." Baghdad with its great Hall of Science, built by the son of Haroun al-Raschid, Cordova with its school of renowned physicians, and Toledo the centre from which, after its capture by Christian forces in 1085, a stream of translations issued—all were bright glowing stars in the firmament of Arab learning. "Islam led the vanguard of progress and the Muslims taught the world," says the emir Ali. For the

PLATE XXXIV

AVICENNA, "PRINCE OF PHYSICIANS", OF ARABIA, DEPICTED IN A JEWISH MS.

This leaf, from a fifteenth century Hebrew translation of the "Great Canon" of Avicenna (in the University Library, Bologna), is a somewhat late example of the great part played by Arab-speaking Jews in spreading the medical and scientific learning of Arabia through "Darkest Europe". In the principal miniature Avicenna,—or to give him his full sounding Arabic name,—Abu Ali Husayn Ibn-Abdullah Ibn Sina—in dark robes is seated, while his pupils dispute before him. The great importance of drug treatment in Arabic medicine is indicated by the well-stored drug shop on the right. The smaller miniatures represent various cases of disease and treatment by bathing, bleeding, etc.

Courtesy of Cavaliere Uff. Dr. Carlo Frati, Bologna.

medieval period this is perfectly true. Nestorian scholars had translated Greek into Arabic and when, by the twelfth century, Islam plays a large part in Europe itself [Map, Plate 33] we see the beginning of that flow of Latinized versions of Arabic translations which produced the partial revival of the thirteenth century.

It is not necessary here to go into any considerable detail of Arabic medicine. Much of its history is anecdotal, much but the arid argumentation of Schoolmen. Still, in spite of the scholasticism it put some much needed fresh blood into the very dry bones of European medicine and for long centuries the names of the great ones of Arabia—Mesuë (Older and Younger), Rhazes, Avicenna, Albucasis, Averroes and others—were names of power in medicine. On these a few remarks may be offered. Mesuë the Older (son of a Nestorian apothecary) was born at Jundeshapur in the eighth century. Rhazes, a Persian who lived in the ninth and tenth centuries was the author of the *Continens*, a medical encyclopædia in twenty-five books (the edition of 1486 weighs seventeen pounds!) and wrote the earliest account of measles and small-pox, differentiating the two diseases accurately. Avicenna, born at Bokhara in 980, called by his countrymen "Prince of Physicians," was not only astronomer, poet and philosopher, but as a physician governed European medicine for four centuries by his *Qanun fil Tebb* or "Canon of Medicine" in five volumes, the most complete medical compendium of his day in which he endeavoured to reconcile Aristotle and Galen—to the perpetual delight and exercise of the Scholastics. As late as 1650 the "Canon" was in use as a text book at the university of Montpellier. Albucasis of Cordova is best known as the writer of a really independent book on surgery. Averroes, born 1120, Viceroy of Cordova and last of the great Arab physicians, was equally famous as a philosopher both in Mahomedan and Christian schools.

Neuburger, summing up the debt which medicine in its evolution owes to the Arabs, says:

> The Arabs imparted individuality to their legacy from the ancients by amalgamating Galenism with oriental elements, . . . by their notable additions to empirical knowledge . . . but they lacked the independence to bring fruitful criticism to bear upon hereditary principles or to create any fundamental novelty.
>
> In the realms of dietetics and pharmacy Arabic medicine showed itself genuinely independent.

With the Arabs begins the real craft of the apothecaries. Public pharmacies existed in Baghdad from the ninth century and the many hospitals and infirmaries had dispensaries attached to them. From the East the Arab physicians added many useful drugs (e.g. cassia, senna, rhubarb, tamarind, camphor, aloes, aconite, etc.), to the formularies although perhaps they must be debited with some share of the evils of polypharmacy from which later centuries suffered.

What we are most concerned with is, not the details of Arabic medical systems, but their effects on the medicine of Europe. The Dark Ages were coming to an end. Fears and thoughts of early world dissolution had died down and the spirit of humanity was arising in fresh vigour. Gothic architecture itself, which begins in the thirteenth century, in its magnificent and mystic aspirations soaring like its heaven-piercing towers and spires, is evidence enough. Among leaders of the intellect stand out St. Thomas Aquinas and Roger Bacon and the teacher of Aquinas, Albertus Magnus. Everywhere are new movements, social, political, religious and intellectual, which have made humanity richer. We are out of the worst of the medieval desert, though thought is by no means free as yet (many thinkers are to suffer by stake and prison for daring to venture outside the body of traditional thought), and it has to be admitted that, apart from Roger Bacon, the advance in science and particularly in medicine was but small. Anatomy and still more surgery show to better advantage than medicine.

Several factors account for this result. The medieval system of thought was too hard and inelastic to permit serious expansion and it was too firmly anchored to the uninspired word that represented all that had survived of Galen and Aristotle to admit principles and practice that were really new or fresh. Nor were matters really very greatly improved when the new Arabic translations arrived, eagerly as they were accepted and studied. Not only had the original Nestorians, translating imperfect Greek originals into Syriac or Arabic added their theological flavour, reconciling pagan thought with Christian, or even suppressing one in favour of the other, but the Arab translators and re-writers had, in their turn, made such modifications as their religion and other local considerations required. A third translation into Latin, or perhaps even a fourth via Hebrew, can have left but little substance of the Greek originals.

It is not surprising, therefore, that in recognizing the masters of Arabic medicine the thirteenth and fourteenth centuries

knew and practised but negligible portions of Hippocrates and Galen's permanently valuable work. The Scholastic mind was more concerned with arrangement, argument and annotation than with the ideas presented. Direct observation is rarely attempted or considered; the authority of a master—Aristotle or Galen—is sufficient to settle any difficulty though the master be quoted inaccurately from a hopelessly corrupt text or his words be twisted by dialectic ingenuity out of all semblance to real meaning.

There yet remains the fact that these translations and commentaries, corrupt and nearly dead though they were, were primarily responsible for the first revival of learning. It was the late twelfth and thirteenth centuries that saw the beginnings of the universities, "these new thinking shops," as Dr. Coulton calls them, and it was on these Arabic-Latin text books that their students were mainly fed and continued to be so fed long after the Renaissance. Oxford and Cambridge began in the mid-thirteenth century but the great medical centres were at the universities of Montpellier (which, said to be founded in the early twelfth century definitely superseded Salerno in the thirteenth), Bologna, Paris and Padua. The teaching was mainly by word of mouth, for it was a bookless age. At the end of the fourteenth century the library of the Paris medical school consisted of no more than twelve books (MSS.), mostly Arabian, of which the immense *Continens* of Rhazes was the most important—a significant light on the scope of medical education, since Paris was a school of real importance. This is perhaps partly explained by the fact that medicine ranked low in the list of university faculties. The greater figures in medicine studied, not at one university, as would suffice for a modern student, but at all. Learning and practice were both personal to the teacher.

This flowering of the university system was in itself a very significant change. In the earlier centuries learning hardly existed outside the Church. It was a foregone conclusion that a literate man would be in orders of some kind. Now knowledge was opening its bounds and so long as it avoided heresy, a matter of some difficulty, it was free. At most of the universities, including Oxford, medical degrees of bachelor, licentiate and doctor were given; Continental medical education was of course earlier than English. At the beginning of the fourteenth century Bologna was foremost. There Mundinus, a professor, revived the study of anatomy which had been almostly com-

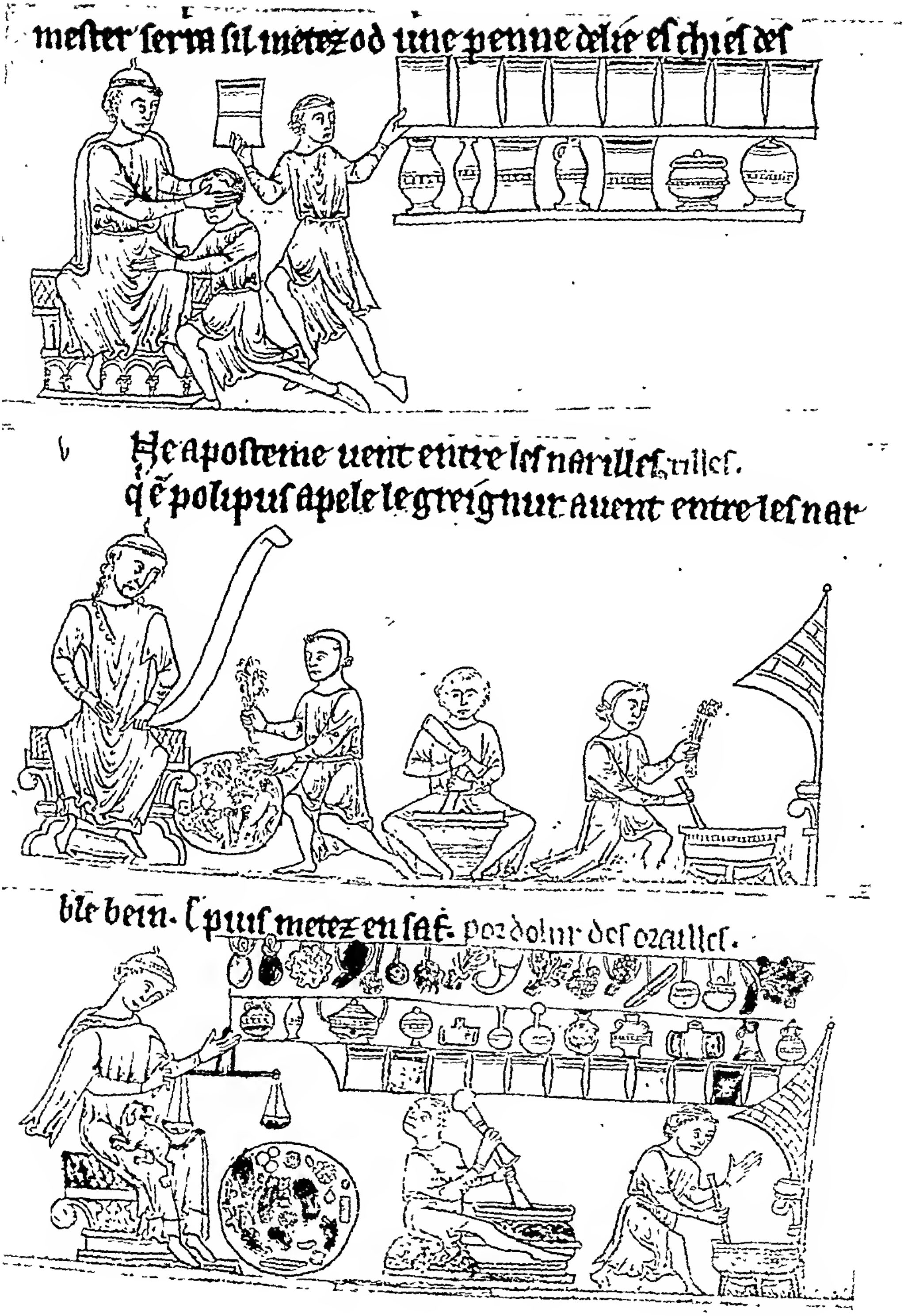
PLATE XXXV

Gathering Simples and Compounding Drugs from a MS. of a Master of Salerno

In Salerno, the twelfth-century centre of medical learning, two writers, whose names stand out in advance of the spread of Arabian learning, were Roger of Salerno and Roland of Parma. The writings of both are mainly of surgical interest, but in the charming set of drawings from a thirteenth century French MS. of Roger we see many illustrations of purely medical practice.

In the two upper drawings the physician is supervising the operations of assistants who bring him herbs for identification, pound them in mortars and brew them over a fire. In the lower drawing a doctor has tied a bandage, with a most unprofessional knot, round the patient's nose.

Trinity College, Cambridge, MS. O.1.20.


mester serra sil metez od une penne de lie es chies des
Ne apostemie uent entre les narilles. rilles.
q̃e polipus apele le greignur auent entre les nar
ble bein. E puis metez en sac. por dolur des orailles.


p ernez girofre· ⁊ comin· ⁊ les coste de pōme gernu
e la puldre uerraaille si cū deuant dit est metez sur la
le linsel oinguez ⁊ quant les burblettes creuerunt

PLATE XXXVI

Patients of a Thirteenth Century Doctor

These further drawings, from the Cambridge MS. of Roger of Salerno, depict (top) salve being applied to an injured eye: the arrival and subsequent treatment of a patient with an exaggerated abscess due to infection from a decayed tooth: one patient being subjected to a somewhat drastic form of heat treatment for a skin disease: while another presents himself with a severe rash—probably intended to represent leprosy.

Trinity College, Cambridge, MS. O.1.20.

pletely neglected since Galen. Among his students was the cultured Guy de Chauliac, "the restorer of surgery" who displayed a righteous scorn for his contemporaries for they "despise everything not sanctioned by custom and authority forgetting that, as Aristotle declares, these are the two great hindrances to the discovery of the truth."

Earlier than Bologna was Montpellier which, being placed in south-eastern France, within reach of Spain, was more accessible to Hispano-Moorish influence and had accordingly the advantage over Paris and other medical schools in its great store of MSS. of Arabian origin. Medicine was taught there in the twelfth century although the Papal Bull founding the university only dates from 1289. Among its great teachers were Arnald of Villanova, Henry of Mondeville and Guy de Chauliac, the last two being surgeons. Arnald (died in 1312) was a prolific Scholastic writer of the Arabian and Salernitan tradition and was one of the earliest editors of the *Regimen Sanitatis* of Salerno discussed in the previous chapter. Sudhoff credits him with its authorship. Theologian, lawyer, philosopher, alchemist and physician, friend of a Pope and a convicted heretic, he was undoubtedly a man of parts. His balance is indicated by his dictum that "the modest and wise physician will never hasten to drugs unless compelled by necessity." Nevertheless he spent much effort in the search for a universal remedy, an elixir which should restore youth to the old. Some of the virtues of such a potion he found in the *aqua vitæ* or alcohol (an Arabian original word) which also had the valuable property of extracting the essence of herbs and roots whence come the "extracts" and "tinctures" of the pharmacist.

Many other names might be quoted. Padua (Shakespere's "fair nursery of Arts") had Peter of Abano, a scholiast who tried conclusions with the Inquisition and escaped the stake by dying in his bed; Peter of Lisbon, who became Pope John XXI; and others.

It is not difficult to prepare a catalogue with summaries and extracts of medieval physicians and writers on medicine whose works have survived and to present such a catalogue—perhaps selected to support a brief,—as a picture of later medieval medicine. Although this method might produce interesting and even amusing results without departing from fact it would not be a true picture because it would be neither complete nor would it indicate clearly any line of advance, any progress in the stream of thought, that might exist. We have indicated the

Arabic content of medicine as taught and practised in the thirteenth and fourteenth centuries and the quickening of thought through the expansion of the universities. Alongside all this went, as in the days of Hippocrates, the mass of popular physic with its absurdities and superstition. Dr. Singer says roundly that, in medicine, there was "an almost complete absence of scientific advance between the thirteenth and sixteenth centuries."

If it is difficult to point to any specific example of advance it is worth while to give a little attention to two encyclopædists who, though they but touched the sphere of medicine, yet displayed an intellectual brilliance and propagated ideas essentially scientific that made genuine advances possible. Both insisted on the necessity for the study of nature and the test of theory by experiment—ideas which are commonplace enough to us. In an age which accepted as statements of fact indiscriminate quotations from traditional authorities arranged on a merely logical basis such a procedure was revolutionary. The simply credulous man was more or less suddenly faced by inquiring incredulity, an appeal to personal judgement and ascertainable fact, an attitude which constituted heresy as it was then understood. It cannot too often be emphasized that the majority of medieval writers did not think of verifying their facts. A garbled quotation from a corrupt translation of Aristotle sufficed. So, although recent research has established that Roger Bacon was not the lonely unheard voice crying in the wilderness which earlier commentators supposed him to be, yet his rationalism, contrasted with the scholasticism of his time, gives his thought a strongly modern flavour. This is a Franciscan, a thirteenth century ecclesiastic, speaking:

> Experimental science has three great prerogatives [or "dignities"] over other great sciences; it verifies conclusions by direct experiment; it discovers truth which they never otherwise would reach; it investigates the course of nature and opens to us a knowledge of the past and of the future.

Much of Bacon's work has only been published since his septencentary in 1914, and the clearest modern view of it may be seen in the studies of Dr. Robert Steele and Dr. A. G. Little. The most important work of the *doctor mirabilis* was his scheme, completed only in part, for an encyclopædia which was to base education, not on formal scholastic logic, but on scientific studies with experimental verification. Of the part completed

the *Opus Majus*, sent to Pope Clement VI about 1266 at his request and recently discovered in the Vatican Library with Bacon's own annotations, displays a width of knowledge which, judged by contemporary standards, is amazing. It shows a real grasp of all the learning of his time including such differing subjects as philology, philosophy, mathematics, astronomy, medicine, alchemy, optics, geography and theology.

In his constant revolt against orthodoxy and his non-credulous attitude towards contemporary problems he ranks as a forerunner of modern scientific thinking. Bacon, says Dr. Little, in his *Roger Bacon: Annual Lecture on a Master Mind* (British Academy, 1928), "saw clearly that when theories are inconsistent with known facts the theories must be sacrificed" and "his insistence that facts should be ascertained before a theory is invented was specially valuable in the Middle Ages." "He had his feet firmly planted in medieval soil and yet had a strikingly clear vision of far-off future things."

He knew something of the possibility of arranging lenses to make "far things appear near and small things large" although the credit for the original idea which foreshadowed both telescope and microscope apparently belongs to his contemporary Grossteste, the great bishop of Lincoln.

His medievalism has several aspects of which two may be illustrated. Early in life (in his thirties) he wrote a treatise on *The Accidents of Old Age and the Prolongation of Life* (he sought to prolong life by secret potions) and he was a wholehearted believer in astrology. In the *Opus Majus* he says that blood-letting "should be performed on a Saturday . . . on account of the malignity of Saturn who generates ill-fortune in all things."—(*Little*.)

With great breadth such as Bacon attempted and to a large extent achieved in his encyclopædic writings none but a superman of a type that humanity has not yet produced can achieve great depth. The results of Bacon's work upon medicine were general although they were profound.

The other of the two great encyclopædists was Albertus Magnus, a German contemporary of Bacon, considered by his countrymen to be at least equal to him if not superior as a scientific thinker. He was the teacher of St. Thomas Aquinas, and like his philosophical master Aristotle, and like Bacon himself, took all knowledge for his province. He translated and interpreted the whole of Aristotle's work and, recognizing the

importance of studying nature rather than books, produced the first scientific botany since Dioscorides (the fourth century Greek) in which he uses the phrase "All that is set down here is the result of our own experience . . . experience can only be of certainty." Medical works were among his writings which were widely read. His contemporaries suspected him of magic —they called him "Great in magic"—because of his wide learning.

It may not unreasonably be said that with men of this calibre interested in medicine there was hope for its general advancement. That advance, in spite of the enormous stir of the Renaissance which we shall comment on in our next chapter, was unfortunately slow in coming, and when we consider the mass of popular medicine in these centuries the reason is fairly clear. We may give an example of this material. In 1276 Peter of Lisbon, who had studied at the medical schools of Paris and Montpellier, became both physician to Pope Gregory X and Cardinal Bishop of Tusculum. The same year, as Pope John XXI, he succeeded Gregory. Having sufficient learning and intelligence to rise to the supreme headship of the Church he is nevertheless the author of an extremely popular book of prescriptions taken from writers of every kind and selected with so complete a lack of discrimination as to include the following from a contemporary writer, called Gilbert the Englishman:

> Gilbert's ointment for gout: Take a very fat puppy and skin him, then take juice of wild cucumber, rue, pellitory, ivy berries, juniper berries, euphorbium, castoreum, fat of vulture, goose, fox and bear, equal parts, and stuff the puppy therewith. Then boil him: add wax to the grease that floats on the surface and make an ointment. Or, if you like, take a frog when neither sun nor moon is shining; cut off its hind legs and wrap them in deer skin; apply the right to the right and the left to the left foot of the gouty person, and without doubt he will be healed.

The reader is asked to turn back to page 34 and contrast the formula with the Egyptian use of weird animal fats for stiffness and ask himself what progress is represented here in an interval of two thousand seven hundred years. Even the Assyrian pharmacopœia fails to produce a remedy quite so futile. Dr. Jastrow discussing Babylonian and Assyrian medicine comments shrewdly on this type of therapeutic:

PLATE XXXVII

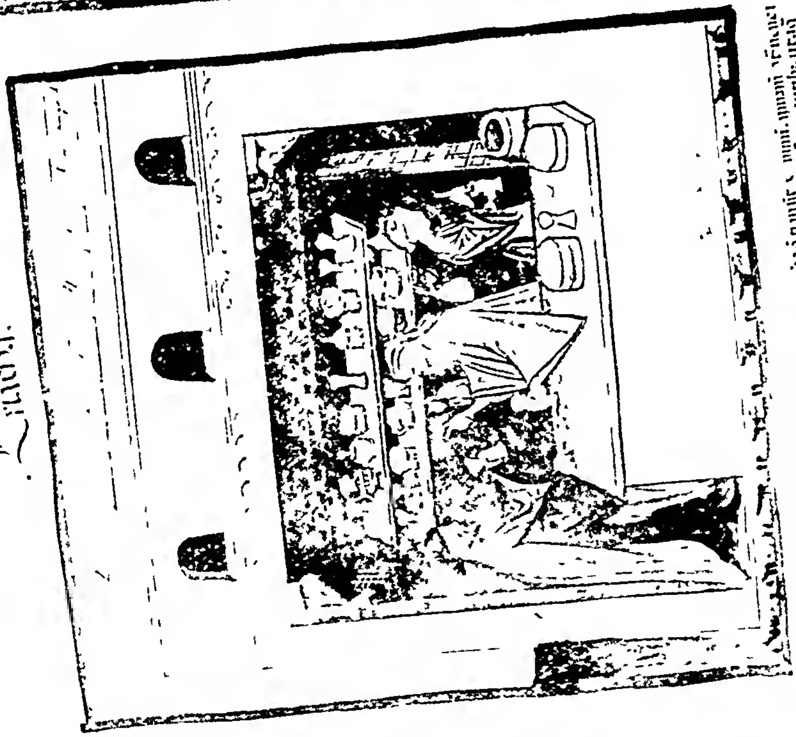
MINIATURES FROM THE VIENNA MS. OF THE "TACUINUM SANITATIS"

The three known MSS. of the work of the Arabian physician, Albucasis of Cordova (translated about 1276 by order of Charles of Anjou), are practically identical with but slight variations in the miniatures which adorn them. One from the Venice MS. is given in colour as a frontispiece to this volume.

Two other examples from the Vienna MS. are given here. On the left camphor is being sold, and on the right theriac, the most famous of all medieval drug preparations, the universal antidote. Said to have been invented by Mithridates, king of Pontus, theriac was an electuary with a massive formula (the "Dispensatory" of Cordus, 1546, gave it sixty-four ingredients) which appeared in various forms in all formularies and pharmacopœias from Roman times down to the German Pharmacopœia of 1882.

Courtesy of Prof. Dr. J. Bick, Director-General of the National Library, Vienna.

Tiriaca.



Camphora.

Plate XXXVIII

PLATE XXXVIII

Thirteenth Century Infirmary for the Sick

Although it is often said that hospitals existed throughout medieval times there were no hospitals in the modern sense of the term in Europe. The many hospitals and almhouses which did exist catered, primarily, for the inmates' spiritual needs, the physical care of the sick consisting mainly of the provision of beds and food and simple, though kindly, attention. These scenes, from a French MS. of about 1250, illustrate the reception and care of the afflicted. Note that, as was a medieval custom, the patients lie naked in their beds.

Bibliothèque Nationale Paris, MS. lat. 8846: *photo, Catala.*

> In the popular remedies of Middle Ages which mark the return of methods the very reverse of scientific and which survive as extra-medicinal elements of our own civilisation, relegated to root and herb doctors and to quacks of all kinds, we may see the continual influence of those ideas and practices which prevented Babylonian-Assyrian medicine from rising superior to its surroundings.

This Gilbert was, says Dr. Singer, the first English physician to make a reputation on the Continent. He studied at Salerno in the early thirteenth century, and produced a voluminous *Compendium of Medicine*, about 1240, based partly on the *Chirurgia* of Roger of Salerno (beautiful MSS. of which exist in the British Museum and at Trinity College, Cambridge—see Plates 35, 36), and for medical matters on the usual Arab authorities. He is one of the two English physicians mentioned by Chaucer in the list of medical authorities in the Prologue to the "Canterbury Tales" where the "doctour of phisyk" is described. The other was John of Gaddesden who took the degree of doctor of medicine at Oxford about 1309, and wrote a lively and popular work, *Rosa Anglica*, about 1314. Medically it was in no way superior to Gilbert's compilation. Guy de Chauliac says of it "I thought to find in it an odour of suavity and I found the fables of Pope John, Gilbert and Theodoric."

Of the state of medicine in England we may judge clearly by the statutes of the university of Oxford about 1325 as quoted by Dr. Gunther in his *Early Science in Oxford*:

> Those skilled in medicine are reckoned more learned than others, since to their discretion are committed the cure of the sick, the perils of death and the ordering of life. Great care must therefore be exercised that only competent persons are allowed to practise or incept in that faculty.

For inception in medicine, we read, the candidate must have read one book of Galen and one of Hippocrates (the *Aphorisms*) for theory and others for practice. For license, book learning for six years was required. No mention is made of clinical experience or of anatomical knowledge. The earliest recorded lecturer on medicine was Nicolas Tingewick, of Balliol, who says Dr. Gunther, was gratefully remembered by Edward I as the physician "to whom after God, we owe thanks for our recovery from the illness which lately oppressed us." (October, 1306.) This recovery was an extremely expensive form of faith-healing for the apothecary's bill for the drugs used amounted

to £134 16*s.* 4*d.* Kings must have kingly remedies for in the very long list of drugs used on this occasion are such costly items as "water of the roses of Damascus" and remedies concocted from pearls, jacynths and coral!

Neither in England nor abroad is medicine yet worth following into further detail. We will content ourselves with remarking that, in sum, its pathology was still that of the humours elaborately sub-divided, its one specific bleeding for nearly all diseases, and its pharmacy empirical and elaborate to futility. The most famous and widely used drug was theriac the universal antidote (see page 70, and Plate 37), with its seventy-five or more constituents, including viper's flesh, which was used at Montpellier until the middle of the eighteenth century.

Of hygiene in the whole of this period there is little that can be said. The conditions of the towns were immeasurably inferior to those of the Roman Empire; in the country they can only be described as semi-barbaric. The thirteenth century peasant lived in a mud-daubed hut in complete and sanitationless squalor [*cf.* Plate 40]; in the previous century his lords, despite their castles, were not greatly superior. Professor Hearnshaw speaking of the expectation of life in the thirteenth century says that a "man of fifty was as rare then as a man of seventy-five now. The majority of children born died in infancy." In the fourteenth matters were even worse: "The growth of large towns at a time when the merest rudiments of sanitary science were unknown, and when medical skill was synonymous with superstitious quackery, was a fruitful source of devastating disease." It was not until 1388, when the prevalence of plague in the peasants' hovels demonstrated the necessity for some form of sanitation, that the English Parliament passed the first sanitary Act and appointed scavengers and sanitary watchmen. The average medieval town lacked drains and was but poorly supplied with water.

Hospitals and infirmaries, attached generally to monastic institutions, and intended for the sick, the aged, the orphan and the blind flourished from the sixth century and developed by the thirteenth into the semblance of a hospital system for it was always the duty of the religious to care for the sick even if under some rules and at some times he was debarred from doctoring them.

Of the medieval sufferings under repeated devastation by plague and the recognition of the process of infection we shall have something to say in a later chapter.

The seeds of decay in the medieval system have been sown at the point at which we leave it—about 1450. The incursion of foreign influences, mainly Oriental, and the enormous expansion of commerce between Europe and Asia, which signalize the thirteenth and fourteenth centuries in spite of their essential medievalism, were in effect the prelude to the destruction of the system of the Middle Ages which, with the powerful intellectual forces developed in the Renaissance, inaugurated the Modern Period.

CHAPTER IX

FOUNDATION OF THE MODERN PERIOD OF MEDICINE: 1450–1600

In 1451 Mohammed II, lord of the Ottoman Empire, and terror of Christendom prepared for the grand attack on Constantinople. For over a century the city with its long walls had preserved its existence by alternating tribute with defiance to the Turkish power. Hitherto, the fortress state on the Bosporus had been impregnable, but when the great siege began in earnest in 1453 only a few months passed before the final assault by sea and by land was launched and on May 29th the last of the Greek emperors disappeared in the slaughter and sack. With him vanished the last centre where the regular language of Court and Church was that of the philosophers and dramatists of fifth century Athens and of Hippocrates himself. The libraries, still stored with the MSS. of ancient Greek learning, were destroyed and their contents and their custodians dispersed abroad. Mostly they fled to Italy.

This catastrophic event but accelerated the change which was developing in intellectual Europe. There had been signs, amid the stagnation of dying medievalism, of the coming flood tide of humanism. Nearly sixty years earlier Chrysoloras, a man of scholarship, had been appointed to the chair of Greek at Florence and Nicholas V, who was elected Pope in 1437 mainly on account of his scholarship, had earlier distinguished himself by discovering the medical portion, *De Medicina*, of a general encyclopædia written by a Roman gentleman, Cornelius Celsus, in the age of Cicero. Since this work contained an excellent historical account of Greek medicine it was of great value and absorbing interest to medical men of the fifteenth century who had never before had access to an uncorrupted classical work.

With the election of the enthusiastic humanist Æneas Sylvius as Pope Pius II in 1458 we may see the semi-official overthrow of Scholasticism. Everywhere the clerks are busy copying the new marvels. For the first time the actual words of the classical masters can be read, untouched by theology and unspoiled by translation

PLATE XXXIX

The Fifteenth Century Doctor Holds his Daily "Surgery"

The physician is distinguished by his fur lappets. As is common in many medieval drawings the artist wishing to show two separate actions has drawn the doctor twice. In the first case, he is attending to the injured arm of a young man: in the second, he is gravely examining the patient's urine in the inevitable flask. Outside other sadly injured patients limp to his door.

British Museum, Royal MS. 15 *E.*2.

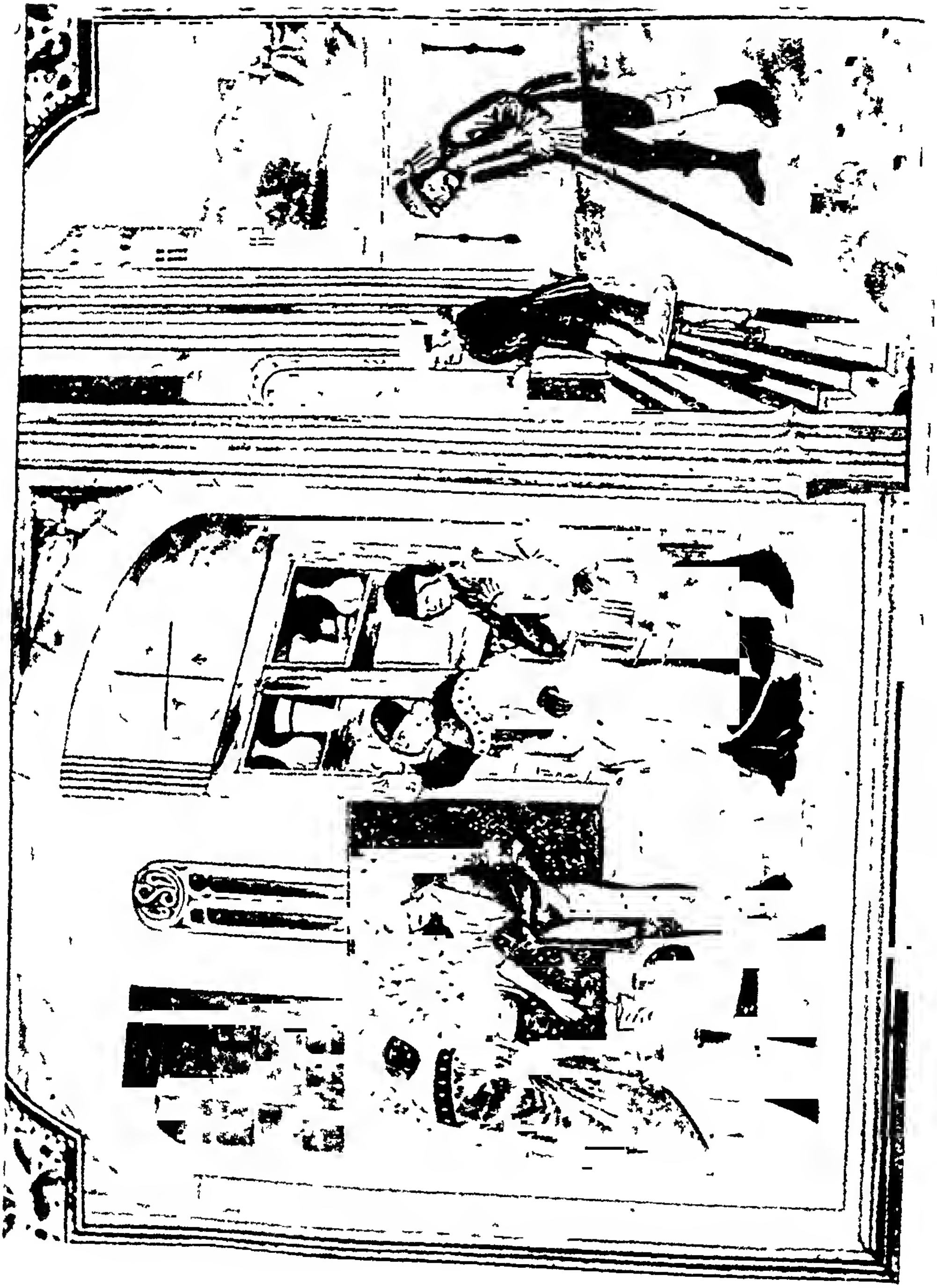


Plate XL

PLATE XL

SQUALOR OF A PEASANT'S HOVEL ABOUT THE YEAR 1500

Late as it is, this French painting well illustrates the conditions of life for the peasant throughout the greater part of the Middle Ages. The sanitationless squalor of their thatched hovels of wattle and daub, with unglazed windows and earth floors, was in utter contrast with the fairly hygienic condition of the Ancient World. Health and hygiene were, of course, absent and the expectation of life from the twelfth to the sixteenth centuries was so low that a man of fifty was regarded as an old man. In France these conditions lasted in many places up to the time of the Revolution. In England the persistence of plague among the peasants compelled the attention of the authorities to the utter lack of rural hygiene and the first Sanitary Act was passed in 1388: little real improvement was achieved before Tudor days.

From Bouchot, " L'exposition des primitifs francais," permission of Librairie centrale des Beaux Arts.

and—equally fortunate—there are men of Greek tongue, ready and able to teach and interpret. The learned world appreciates to the full the treasures that have fallen to it and the scholars and students of Europe flock to Italy. For the next century they work hard at editing and translating helped immensely, in their task of spreading the light of the classical world and humanizing the medieval world, by the new invention of printing.

It is not, perhaps, surprising that the advance in scholarship was not equalled by the advance in medicine. The notions of experimental science were in existence but the tradition of the schools was too strong to permit any immediate application of the new knowledge. Even printing did not help greatly. Sir William Osler notes in a bibliographical monograph that of one hundred and eighty-two editions of medical books printed before 1480 only six were classical: including Pliny's *Natural History* (1469), Hippocrates (1473), Galen (1475), and Celsus *De Medicina* (1478). Inevitably some clung to the masters they knew—the Arabs. Montpellier University at their head persisted, as we have noted, into the seventeenth century.

Inevitably also persisted the dead hand of medievalism. While the schools of Italy hummed with the disputations of the new scholarship Montpellier and Oxford slept and Avicenna ruled. Some features lasted well beyond the recognized limit of the Middle Ages. Dr. Gunther notes that right into the middle of the sixteenth century figures of the Zodiac man in which every part of the body was assigned its Zodiacal figure were still being printed. *A Prognostication*, by Leonard Digges, "imprynted within the blacke Fryars", 1555, gives "a conducible note for letting bludde":

> These signes are mooste daungerous for bludde letting, the *Moone* beyinge in them, *Taurus*, *Gemini*, *Leo*, *Virgo*, and *Capricorne* with the laste half of *Libra* and *Scorpius*.

The practice of astrology and horoscopy required that the medical man should possess skill in mathematics, a connection which undoubtedly played its part in the formation of the iatro-mathematical school of medicine which flourished in the seventeenth century, and is commented on in its place.

Another medieval factor which persisted in exaggerated form even into the seventeenth century, was diagnosis by inspection of the patient's urine—uroscopy. For some four centuries it was so general a method that the flask used, the urinal, became the physicians' sign and urine conditions were systematized in

immense detail and elaborate diagrams that provided the physician both with easy mechanical methods of diagnosis—often at a distance—and means of cloaking his ignorance.

These examples may be taken as indicative of the general condition of medicine, particularly outside Italy, so far as it affected the patient. (Anatomy, with Vesalius (1514–64) greatest of all anatomists, was in a much better state but we are not concerned with that vast subject here.) The work of the scholar physicians did but little for the suffering of their own century but it was of the greatest importance for later generations for it changed the attitude of students from uncritical respect for the word of authority to keen search for, and unbiased examination of the facts of nature. In other words scientists replaced the Schoolmen and the spirit of criticism was reborn.

Of these medical humanists the most interesting to us and perhaps the best examples, are the Englishmen, such as Linacre and Caius, who were greatly influenced by Erasmus. Thomas Linacre, born in the early years of the Renaissance, graduated in medicine at Padua, studied Aristotle and Galen in the originals, and produced the best Latin version of Galen. He had gone to Rome on an embassy of Henry VII, returned to Oxford as lecturer on physic and Greek (Sir Thomas More was one of his pupils) and going to Court became, early in the sixteenth century, physician to Henry VIII.

From his association with the crown resulted the great achievement of Linacre's life. In 1518 he obtained a charter from Henry VIII constituting the Royal College of Physicians, so giving life to the oldest existing purely medical institution in Europe. Although nine years earlier Henry VIII had issued the first English Act regulating medicine, requiring examination and licensing and forbidding "unlicenst folk" to practise, Linacre had observed the evils that continued from treatment by empirics, quacks and even by illiterate monks licensed by bishops (a power which, though a dead letter, resided in the Archbishop of Canterbury until it was abolished in 1838). These evils are recited in the charter itself.

> Before this period, a great multitude of ignorant persons, of whom the greater part had no insight into physic, nor in any other kind of learning; some could not even read the letter on the book, so far forth, that common artificers, as smiths, weavers, and women, boldly and accustomably took upon them great cures, to the high displeasure of God, great infamy of the faculty, and the grievous hurt, damage and destruction of many of the King's liege people.

This college was constituted as a corporate body of approved physicians with the sole privilege of admitting persons to practise as physicians within an area of seven miles round the city of London. Of the growth of that seedling it is not necessary to speak here. Linacre was its president until his death in 1524.

John Caius (or Kaye), an early successor of Linacre in the presidential chair of the Royal College, was another scholar-physician who had gone to Italy for his scholarship. He lectured at Padua on Aristotle, studied the Galen MSS., and lodged with Vesalius, so gaining that interest in anatomy which entitles him to be described as the founder of its study in England. He did not confine himself exclusively to book study for he was, says Dr. Arnold Chaplin, "the first in the country to write a treatise on clinical medicine and his short work on the sweating sickness is the precursor of the work of Sydenham and Heberden."

We may usefully quote Dr. Chaplin's estimate of the work of these scholar-physicians from his Harveian Oration of 1922:

> These men were deeply versed in all the learning of the age in which they lived, and their knowledge of medicine came to them in the ordinary course of their studies. They were scholars first, and sometimes their interest in medicine was inconsiderable.
>
> But when the revival of learning began to influence Europe the stationary period of medical and scientific knowledge soon showed signs of passing away, and it became no longer possible for the scholar to keep up with the advances that were being made. For the revival of learning had let loose upon the world experimental science, and scholarship alone was incompetent to deal with the problems that arose. For these reasons, therefore, soon after the middle of the sixteenth century, science, including medicine, became divorced from scholarship, and a new race of men arose who dared defy written authority, and who inquired only of Nature for the revelation of her secrets. In this way was prepared the road for the great scientific advances which took place in the seventeenth century, one of which was the appearance of Harvey's great work.

In the Letters Patent of Henry VIII founding the Royal College the second name was that of John Chambre, of Merton College, Oxford, physician to the king. He seems to have been an accomplished apothecary as well for in one of the Sloane MSS. (1067) in the British Museum are preserved formulæ for complicated plasters and ointments which he and his royal master devised. An example may interest:

A blacke plastre devised by the Kinges hieghnes.

Take

gummi armoniaci oz. iiij,
olei omphacini [olive oil] oz. ii,
fyne thebinthine oz. vj,
gummi Elemi [i.e. of a special cedar], j,
Resun pini oz. x.

Boyle them together strongly on a soft fyre of coolys in a faire basyn, allwayes styrring it untill it be plaster-wyse; and so make it uppe in rolles, and kepe it to your vse.

Henry VIII was much concerned with the medical profession. In addition to the first Act already mentioned and the more famous one of 1540 incorporating the Barber-Surgeons' Company as depicted by Holbein, he secured the passage of four other Acts dealing with surgeons and medicine. Before his regulating Acts the actual daily practice of medicine was in the hands of the barbers and apothecaries. The physicians were few and mainly in the service of the nobles and the crown. Companies of these "barbers" existed in the principal towns from the fifteenth century. A grant of Arms to the London company in 1451 speaks of them as "Masters of Barbery and Surgery within the Craft of Barbery." The apothecaries were recognized in the last of Henry's medical statutes which empowered unlicensed folk to treat simple diseases. The Act mentions these "persons not being surgeons" with praise for their charitable dealings with the poor. The Apothecaries' Company belongs to a later century.

So the world is once more in possession of the true wisdom —not the teleologically twisted tradition—of the ancients, and if it and even the primary work of the great men of the two following centuries, of Vesalius and Harvey, did not materially alter the current medical practice, its indirect influence was sufficient to arouse that spirit of enquiry which brought modern medical science into being. Among those who worked in this spirit and so assisted not only in the spread of true humanism and the eventual triumph of science in medicine a few outstanding names may be mentioned. Francois Rabelais, the humorist and satirist, did much to promote scientific teaching of anatomy and of botany. His studies in the latter subject along with the work of Leonhard Fuchs and Otto von Brunfels, whose splendid herbals were illustrated with drawings of exquisite art taken from the living plants, did much to improve

PLATE XLI

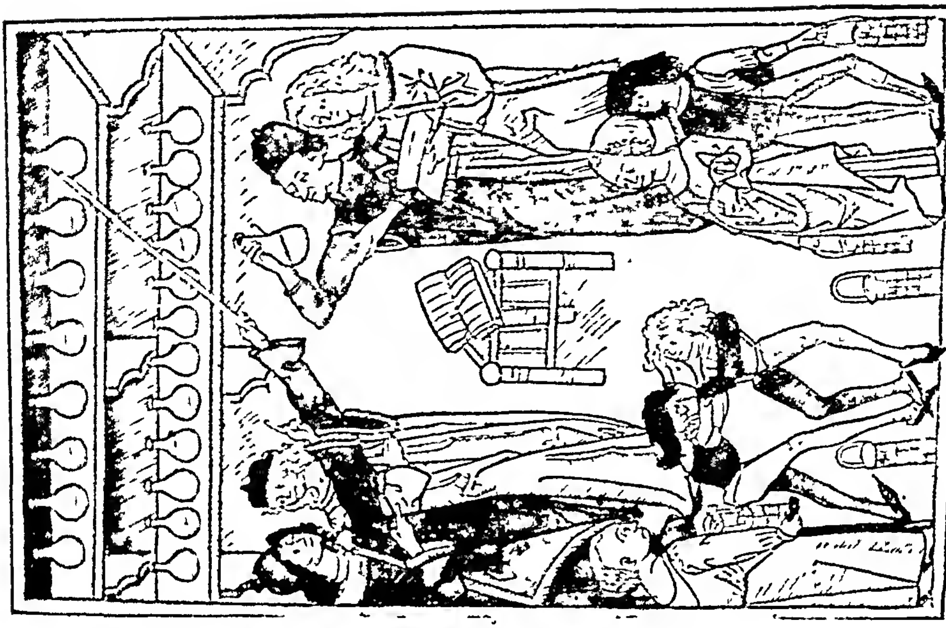
German Physician of the Type Against which Paracelsus Fulminated

These illustrations from coloured woodcuts which date from 1491, two years before the birth of Paracelsus, give adequate representations of the average type of the German doctor of the late fifteenth and early sixteenth centuries. On the left, a woodcut, illustrating a chapter headed "De Urinis," clearly exemplifies the immensely exaggerated importance attached to uroscopy. Physicians and assistants declaim and demonstrate the conditions represented by no fewer than twenty urine bottles. Comic relief is supplied at the foot.

The second woodcut shows doctor and learned professor, in university gown, engaged in earnest disputation, while patients in every variety of condition and disorder are, so to speak, strewn around.

These woodcuts are taken from an immensely popular German Herbal which, originally printed at Mainz in 1485 as the *Herbarius zu Teutsch*, became in 1491 the better known *Hortus Sanitatis*, of which a very large number of editions were printed.

British Museum.



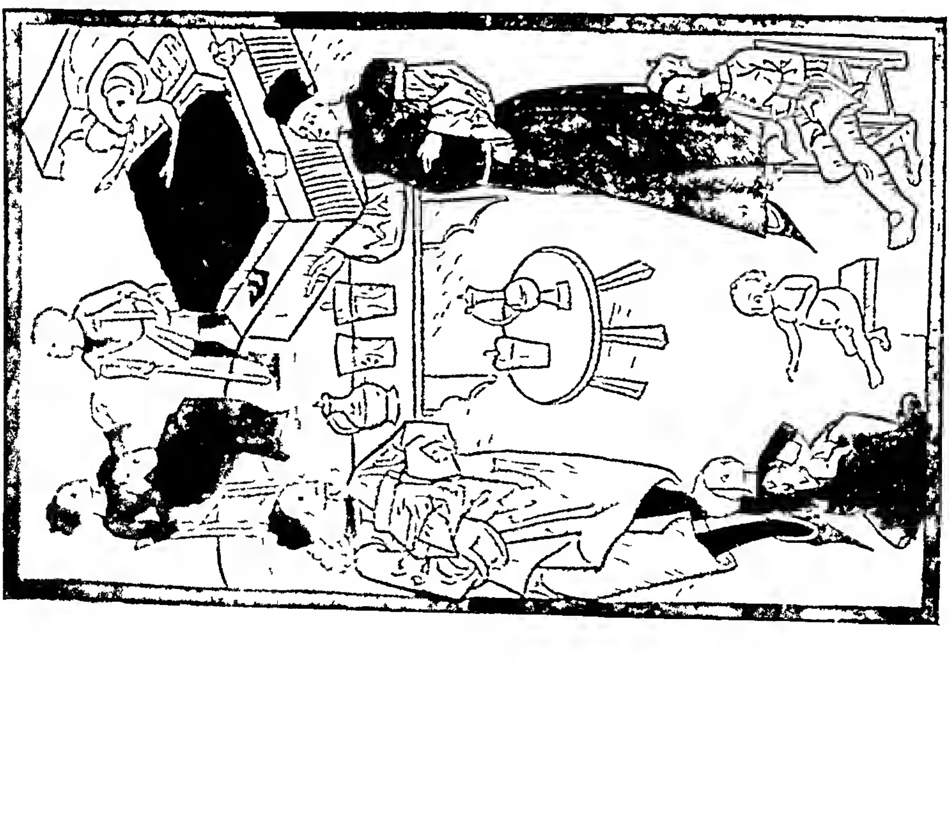
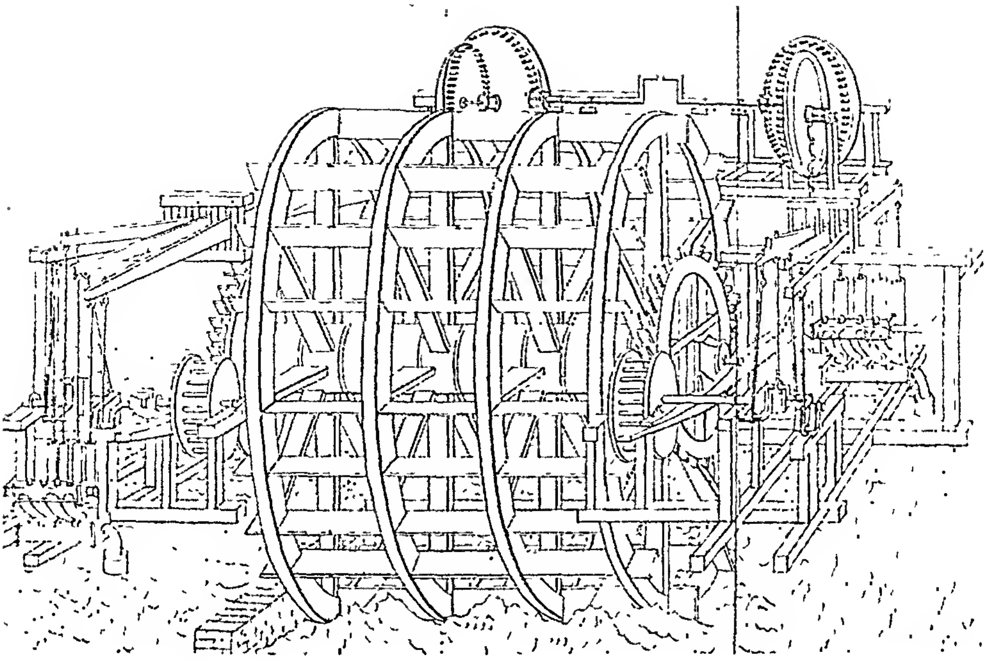


PLATE XLII



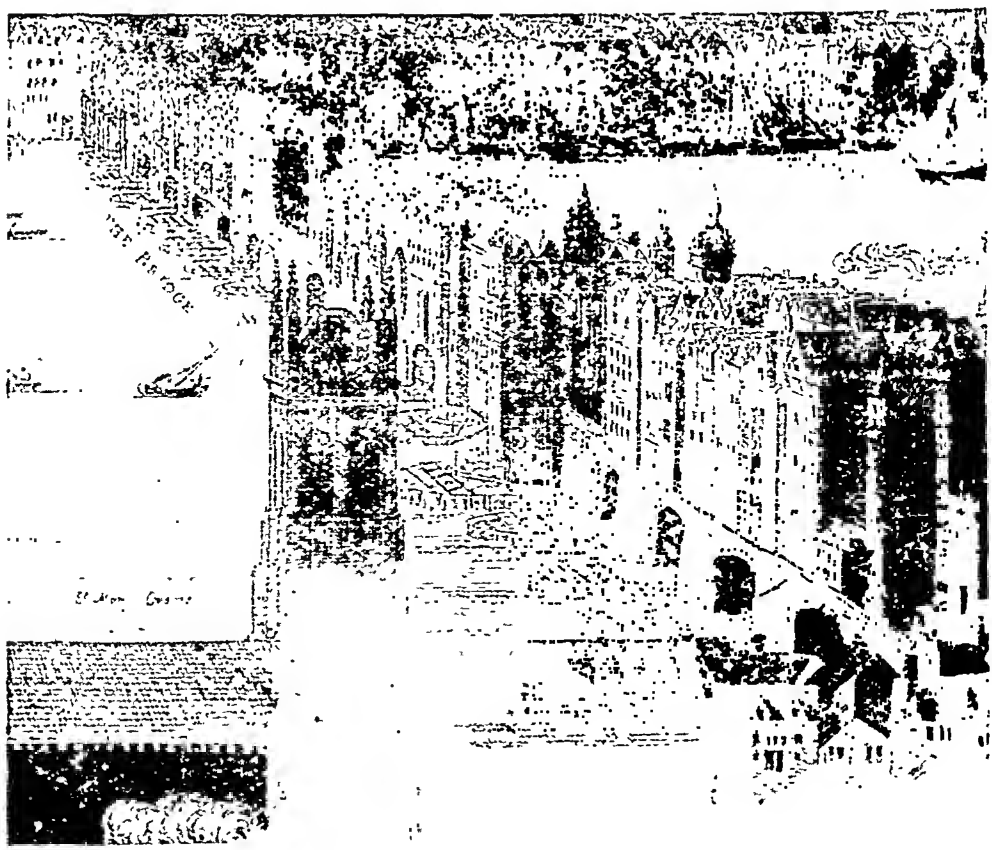


PLATE XLII

OLD LONDON BRIDGE AND ITS WATER-WORKS

A successful tidal pump for supplying river water to London was installed in one of the arches of old London Bridge by Peter Morrys in 1582. The excerpt from Visscher's View of London, 1610, shows the bridge from the Southwark side, the water-works being established under the arches at the city end.

The engineer's drawing of one of these tidal wheel pumps, from 'Hydraulia' by W. Matthews, 1835, based upon a description by Beighton in the *Philosophical Transactions*, 1731, shows the double set of pumps worked by gearing and cranked levers (somewhat in the manner of Trevithick's famous steam pumping-engine), connected on either side of the four-rimmed water-wheel. This system lasted until 1822, and had its own effects in increasing the obstruction of the river at the already obstructive bridge. An example of the other type of source of supply, the conduit head, is seen in Plate LV.

the accurate preparation and administration of drugs. Joannes Montanus, teacher of John Caius of Cambridge, developed scientific methods in disease investigation. Francis Bacon was in some respects in advance of his age. His method of inductive and experimental science laid down in the *Novum Organum* pointed out the right road to sound knowledge but had little or no effect on the medical science of the two centuries in which he lived. He has been given the credit of being the first thinker to understand the scientific importance of the Hippocratic system of clinical record; it is discussed in *The Dignity and Advancement of Learning.* William Gilbert, President of the Royal College of Physicians and court physician to Elizabeth and James I is noteworthy for his work on magnetism, *De Magnete*, which founded the science of electricity. His researches are mentioned in the *Novum Organum* as examples of the true method of experiment and deduction.

The Elizabethan period was, as even the schoolboy knows, one of great activity of spirit and military adventure. Surgeons were attached to the Crown forces, and several of them have left works of importance and interest. On the medical side are one or two printed books, such as *Bullein's Bulwarke of Defence against all Sicknes, Sorres, and Woundes, that dooe daily assaulte mankinde*, published in 1579, after his death, an original composition. He also wrote *A Comfortable Regiment against Pleurisi* (1562).

A writer of unusual interest, at least to the present study, was Andrew Borde, '*Doctor of Phisicke*,' and author of

> The Breviarie of Health: Wherein doth follow, remedies, for all manner of sicknesses and diseases, the which may be in Man or Woman. Expressing the obscure termes of Greke, Araby, Latin, Barbary, and English, concerning Phisicke and Chirurgerie.

This work, first published in 1547, and several times reprinted, contains curious yet clear lights on the hygiene of the sixteenth century. Sir Clifford Allbutt says that Borde not only "visited and revisited the universities of the continent," but was, "perhaps, the first writer on sanitation after the passing of Salerno and perhaps the first after Hippocrates to discuss the aspect and health of the dwelling house." We give two extracts from the 1575 edition of the *Breviarie*:

Of the Pestilence.

> Epidimea is the greke word. In latin it is named Pestilencia, or Febris pestilencialis. In Englishe it is named the pestilence.

The cause of this infirmitie.

This infirmitie doeth come eyther by the punishment of God, eyther els of a corrupt and contageous ayre, and one man infected with this sicknes may infect many men, this sicknes may come also with the stench of evill dirtie stretes, of Channelles not kept cleane, or standing puddles, and stinking waters, of seges, and stinking draughtes, of shedding of man's bloud, and of dead bodyes not deepely buryed, of a great company being in a little or small rome, or common pissing places, and of many such lyke contagious ayers. . . .

A remedy.

The chiefe remedy that I do know, is for every man to submit him self to God, and than to amend our living, and to flee farre from infectious places, and not to go into the company of them which be infected, or do resort to infectious persons, and to beware of the clothes, or any other thing that doth perteyne to such infective persons. Then use a good dyet in eating and drinking, and use of perfumes in your chambers and houses, goe not abroad in the open ayre, late in the night, nor ryse not early in the morning, let the sunne have dominion over the ground, to wast & consume all contagious mistes, and ayres or you aryse, and then aryse and serve God which doth geve health to all men. . . .

Of flees.

Publicia is the latin word. In greeke is named Psilla. In Englishe it is named flees, the which doth byte and sting men in theyr beddes.

The cause of them.

The cause of the ingendring of flees commeth many wayes, they be ingendred of a corrupt dust, and the sweat of dogges doth ingender them, and so doth unclene keeping of houses and chambers, and beddes.

A remedy.

First kepe the chambers and house clene, and use no olde Rishes nor bentes in the house, sweepe the house and chambers oft, and make the beddes betyme in the morning, and lay a blanket on the grounde in house or Chamber, and all the fleas will leape into the blanket that is upon the ground, and so may you take them, and strawe the Chamber with Walnut leves, & if thou wilt anoynt the body with bitter Almons or with the oyle of wormwood.

Among the evidences of a better outlook on life in these two centuries were the signs of public concern for the purity of water, the prevention of nuisance (in our modern sense of the word), and the cleanliness of the highway. Professor Sudhoff has noted a large number of ordinances issued by the towns of the later Middle Ages dealing with these matters.

The first public sewage plant and waterworks were possessed by the city of Bünzlau in Silesia, in 1543, where the sewage was

shows the first small beginnings of tropical medicine. Dr. Charles Singer has reproduced in facsimile one of the earliest works designed to meet this need. It is entitled *The Cures of the Diseased, in Remote Regions. Preventing Mortalitie, incident in Forraine Attempts of the English Nation* (London, 1598). Dr. Singer has established the authorship as belonging to George Wateson or Whetstone, an Elizabethan poet and gallant, who fought in the Low Countries and went with Humphrey Gilbert to Newfoundland. It is little more than a pamphlet, as its contents (in rhyme) show:

The Bookes Content

The burning Feuer, calde the CALENTURE,
The aking TABARDILLA pestilent,
Th' ESPINLAS prickings, which men do endure,
CAMERAS DE SANGRE, Fluxes violent,
Th' ERIZIPILA, swelling the Pacient,
The TINOSO, which we the SCURUEY call,
Are truly here describ'd, and cured all.

Calenture is sunstroke, Tabardilla, yellow fever or a form of plague, Espinlas, prickly heat, Cameras de Sangre, the bloody flux or dysentery, Erizipila, erysipelas, Tinoso, scurvy. Whetstone comments on the use by "the Indians and many other savage people" of the juice of "Tobacco" in poisoning and other conditions. We may briefly remark that this was one of many new drugs which came to Europe after the discovery of America. Most of them were described and figured in John Frampton's *Joyfull Newes out of the Newe Founde Worlde* of 1577. "Tabaco," as he calls it, was then considered as a specific against the new disease syphilis. Other new drugs were hiuourake (guaicum), ipecacuanha, and later, cinchona, or Peruvian bark, said to have been used to cure a Jesuit in Peru about 1600 (its tercentenary in 1930 dated from the first definite European knowledge of the drug). Its importance in the treatment of malaria cannot, of course, be over-estimated.

We have discussed the scientists, the scholars and the practical men. There remain the mystics and reformers who are summed up in a remarkable and difficult figure of intriguing and perpetual interest—the man who, born Von Hohenheim, called himself, or was called, Theophilus Aureolus Bombastes Furioso von Hohenheim, and, shortly, Paracelsus. His name added a word to the language—"bombastic"—which his enemies in his lifetime and his many detractors since have used against him

with destroying scorn. He was a German and German scholarship lead by Sudhoff has done much to rehabilitate him. To men of his age he was offensive to the last degree for, as in every revolution there are those who wish to destroy the whole of the existing system, so the revolt from the schools called the Renaissance produced in Paracelsus its chief iconoclast. He was born in Switzerland in 1493, son of a physician. He wandered throughout Europe until he was 30, taking his degree as doctor of medicine at Ferrara in 1515. Between that time and 1536 he planned and, in part executed, a number of comprehensive medical works as well as an immense number of individual studies distinguished by impetuous originality, a wealth of observation and ever increasing knowledge.

As a reformer who cared not to mince his words Paracelsus quickly stirred up enmity on his appointment as city physician of Basle and lecturer in medicine at the university. He committed the unforgivable offences of lecturing in the common tongue instead of the professional Latin (he was the first to do so) and of denouncing the elaborate prescriptions, containing sixty or more items, of the day. He told his colleagues roundly.

> This is the cause of the misery in this world—that your science is founded upon lies. You are not professors of the truth, but professors of falsehood. It is not the opinions which a person holds, but the work which he performs, that constitutes a physician.
>
> This doctorship—this true understanding—is not conferred by emperors or popes, or high schools, but is a gift of God. I am protecting my kingdom, not with empty talk, but with the power of the arcana (mysteries); not with such as are bought in apothecary shops, but with the arcana of Nature, such as have been revealed to me by Nature herself.

He followed this with the more spectacular crime of beginning his course of university lectures with a public burning of the works of Galen and Avicenna. In the introduction to his *Paramirum* he says:

> You are to be my followers, and not I yours. Me! Me! I say, you will follow—You, Avicenna, Galen, Rhazes, Montagnana, and Mesues. I shall not be your follower, but you shall be mine. You men of Montpellier, and Cologne, and Vienna, you Germans, men of the Danube and Rhine, and the Maritime Islands, Athenians, Greeks, Arabs, and Israelites—I am not to follow you, but you shall follow me; nor will anyone hide even in the darkest corner. I am to be the monarch, and the monarchy will belong to me. . . .

Some familiar note is struck in the scorn for contemporaries; one's thought goes back to an earlier and greater figure who also cried over loud—Galen whom Paracelsus so violently despised.

This conduct and this bombast, if not lacking in courage and in value for the destruction of medieval idols, was not conducive to peaceful work and in less than two years Paracelsus was on his travels again. It will serve no purpose here to follow those wanderings or even to recite titles from the long list of his literary remains. Rather let us attempt an estimate of his permanent value to medicine as summed up in the judgements of acknowledged authorities.

First we may let him speak for himself. If the following statements of principle are genuinely his (and the confused state of his great mass of writings largely unfinished raises many questions of authenticity) he can hardly be seen in a more favourable light:

> The best of our popular physicians are the ones who do the least harm. But unfortunately some poison their patients with mercury, and others purge or bleed them to death. There are some who have learned so much that their learning has driven out all their common sense, and there are others who care a great deal more for their own profit than for the health of their patients. . . . A physician should be the servant of Nature, not her enemy; he should be able to guide and direct her in her struggle for life, and not throw, by his unreasonable influence, fresh obstacles in the way of recovery.
>
> The knowledge of Nature is the foundation of the science of medicine.
>
> If you wish to be a true physician you must be able to do your own thinking, and not merely employ the thoughts of others.
>
> To be an alchemist is to understand the chemistry of life. Medicine is not merely a science, but an art; it does not consist in compounding pills and plasters and drugs of all kinds, but it deals with the processes of life, which must be understood before they can be guided. A powerful will may cure, where a doubt will end in failure. The character of the physician may act more powerfully upon the patient than all the drugs employed.
>
> The patient must not be out of the physician's mind day and night. He must put his whole power of reasoning and his judgement deliberately in the service of his patient.

His two great works were the *Paramirum*, a treatise dealing with the causes and nature of disease planned in his early years and re-written about 1531 after he left Basel, and the *Paragranum*, a work which Sudhoff considers of fundamental importance

for it expounded the general principles of medicine. It is from the latter work that most of the quotations above are taken.

The dual personality of Paracelsus is probably responsible in part for the opposition of opinion concerning his worth. The scientific rationalist mind finds it difficult to tolerate the mystic, cabalist, astrologist, so blatantly evident in his pronouncements and diffused writings. Dr. Withington, who is a keen critic, considers that Paracelsus "sought to introduce theories and speculations more vague than those they were intended to supplant," and that his admirers, among whom he classes theosophists anxious to recognize a "great adept" in mystic lore, a Magi, have "erected an imposing monument on slight foundations." Writers of the seventeenth century, including Francis Bacon, had hard things to say. Fuller called him "a drunken quack." The nineteenth century saw the beginnings of a Paracelsus cult and his hermetic and alchemical writings were edited and translated.

Among his modern admirers is Professor Sudhoff who calls Paracelsus "one of the founders of the modern period of medicine." To Sir William Osler he is "the Luther of medicine, for when authority was paramount he stood out for independent study." Through him "a great stimulus was given to the study of chemistry and pharmacy and he is the first of the modern iatro-chemists" (of whom more is said in a later chapter). Alchemy according to Paracelsus "is to make neither gold nor silver; its use is to make the supreme sciences and to direct them against disease." Three substances were the essential ingredients of all things, organic or inorganic—sulphur, mercury and salt (to be regarded in this connection as qualities rather than the specific chemical substances). From them Archæus, the spirit of nature, which we meet in all the writings of his later pupil, Van Helmont (see page 143), formed everything.

Although he was an occult and an astrologist (his *Practice of Astrology* was published in 1529), yet he declares in the *Paramirum* that the "stars control nothing in us; they are free from us and we from them. The Archæus, not stars, controls man's destiny."

If, as Osler, Stillman and other authorities think, the even greater mystic, Basil Valentine, was a non-existent person whose works were largely made up from Paracelsean writings, we may credit Paracelsus with the discovery of zinc, various mercury compounds, calomel, hydrochloric acid and certain salts of antimony, the use of which he persistently advocated. If Basil

Valentine was an independent person (the curious *Triumphal Chariot of Antimony* appeared at the end of the sixteenth century under his name) Paracelsus was a plagiarist.

His other concrete merits may be stated in a few words and, despite characteristics unsympathetic to the modern mind, he must have had merits or he would not have been the friend of so scholarly and critical a humanist as Erasmus. Certainly he condemned polypharmacy—"the longer the prescription the less the virtue"—and he also poured scorn on the infantile practice of uroscopy which, as we have seen, survived so late in time. He insisted on moderation in bleeding and on keeping wounds clean. A signal merit in the eyes of admirers of the Hippocratic ideal is the high respect which he avowed for the teachings of Hippocrates while rejecting practice founded on Galen, Rhazes and Avicenna.

There we leave him and his times. Before we continue the consideration of the development in the next century of the ideas and forces which his volcanic energy in part set free, we must turn back to discuss, very briefly, a factor of the greatest medical importance throughout the centuries of the Christian era—the story of infection and epidemic, of plague and pestilence.

PLATE XLIII

Aromatics to Keep off Plague

Ideas more or less vague concerning infection were forced upon those who lived in the plague centuries. A very general notion was that since the air was polluted infection could be warded off by sweetening it, as by the burning or other use of aromatic substances. The idea persisted until the nineteenth century in the judges' bunches of sweet-smelling herbs supposed, though repeatedly found to be ineffective, to preserve them from gaol fever (typhus). One form regularly adopted in plague epidemics was the pomum ambre, an "amber apple," made up with aromatic drugs and amber or resin. It was to be smelt continuously as in this drawing of 1493 of a physician feeling the pulse of a plague patient, which illustrated a Venetian work on the plague by Piero Tassignano.

From Charles Singer, 'Fascicule di Medicina' in "Monumenta Medica."

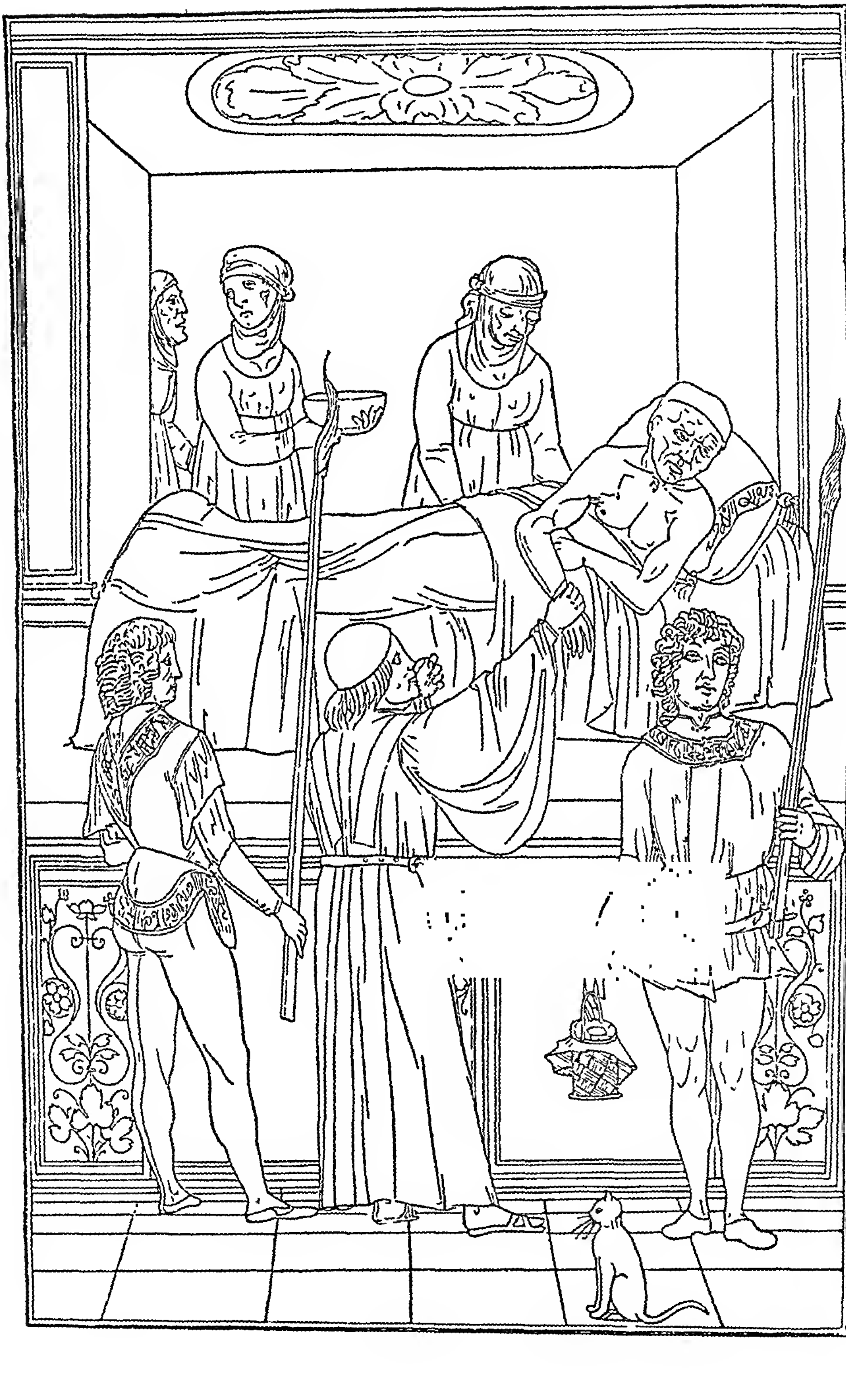


Plate XLIV

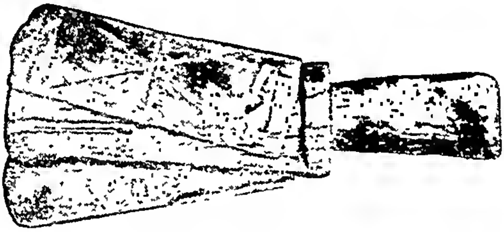


PLATE XLIV

Medieval Enemies, Leprosy and Plague

The leper's distinguishing clothing and his warning clapper, two of the means by which he was compulsorily cut off from intercourse with his fellows and the spread of the disease checked, are well seen in this illumination from the fifteenth century *Miroir Historial* of Vincent de Beauvais. An example of an English leper's wooden clapper from the Wellcome Museum is also shown.

Bibliothèque de l'Arsenal, Paris, MS. 5080; *photo, Giraudon.*

The frightful mortality which resulted from the Black Death is indicated by this host of coffin bearers and sextons at Tournai in the Low Countries, in 1349. The illumination is taken from the *Annales* of Gilles (Aegidius) Le Muisis, who was abbot of St. Martin at Doornik.

Bibliothèque Royale, Brussels, MS. 13076; *photo, Giraudon.*

CHAPTER X

THE ENEMIES OF MAN: PLAGUE AND EPIDEMIC

In the foregoing chapters reference to specific diseases has been omitted except in so far as it was necessary to give examples showing the antiquity of disease and ancient methods of dealing with it. Broadly, medicine is best considered, especially in early times, as dealing with general conditions rather than with specific ailments. The persistence of the sterile doctrine of the humours—whose derangement was, for fifteen or more centuries, thought to be the root cause of disease—is sufficient to justify this attitude. The vast mass of medieval drug pharmacy and recipe treatment had little more than a pragmatic, rule-of-thumb relation to the diseases they pretended or seemed to cure. It is remarkable in fact how little of value has survived. Accordingly we have preferred to discuss health and ill-health and medical and hygienic methods rather than to fill our pages with antiquarian descriptions of ill-diagnosed and misunderstood diseases which can only interest the technical historian of medicine.

Here, however, we pause in our general survey and look back to consider a theme of despair which arises periodically from the earlier to the later times: the helplessness of man in the face of his cruellest enemy—"the pestilence that walketh in darkness . . . the destruction that wasteth at noonday" (Ps. xci. 6). The cry of the Hebrew smitten by the pestilence sent by the Lord in His wrath, the Saxon shuddering at the "vile flying things" or "venoms" which he considered to be the cause of epidemic disease, the utter terror and horror of men of the fourteenth century and the hideous devastations of Elizabethan and Jacobean England, where "death hath pitcht his tents"—all reflect the common factor of complete helplessness in the onset and awful progress of plague. Physician, priest, king and government, alderman and official—none could check its sway and most sought refuge in flight, thereby only spreading it further abroad.

This helplessness was due to lack of knowledge; ignorance of the real nature of the disease, of its cause and of its method of propagation. It is a chilling thought that ignorance under the first two heads has only been dissipated less than half a century ago. Even a medical historian of the standing of Charles Creighton in his *History of Epidemics*, published in 1891–94, considered the plague to be "a soil poison generated out of the products of cadaveric decay." Bacteriology began in 1870, but it was not until 1894 that a Japanese scientist discovered the bacillus of plague, and only thereafter were the dual nature of the disease (bubonic and pneumonic) and its propagation by the rat flea established.

It has to be admitted that we owe our immunity from disasters of plague not only to modern methods of quarantine and port inspection of incoming vessels but also to the merely incidental facts that the black or house rat was displaced in the seventeenth and eighteenth centuries by the brown or sewer rat, which does not breed inside the house, and also that those centuries saw the change from wood and plaster in house construction to the cleaner brick and stone which provided no material in which rats could nest. From the sixth to the eighteenth centuries plague was endemic in Europe, breaking out into fierce epidemics at intervals up to the early eighteenth century.

Ideas of contagion and infection had been current for many centuries though their vagueness but rarely permitted success in combating infectious disease. We moderns, to whom the notions of disease and infection are hardly separable, cannot easily appreciate the mental attitude of earlier centuries when micro-organisms were unknown and the wisest men talked of miasmas and for safeguards burnt herbs or carried scented pomanders [Plate 43]. Before Fracastoro (1483–1553) there was no clear exposition of the theory of infection as we understand it. Babylonians, Egyptians, Hebrews, all recognized the existence of infectious disease (as we have noted in earlier pages), but apart from mystic "demons," "hand of a ghost" or "the wrath of the Lord" it does not appear that more than the fact of infection was realized though it is perhaps more than a curiosity that the emblem of the Babylonian god, Nergal, god of pestilence and destruction, was the fly, which we now know to be a disease carrier. The Hebrews appear to have been well aware of the facts of contagion (see Chap. II). Again it is perhaps more than merely curious that in the plague of Ashdod when "the hand of the Lord was heavy upon them of Ashdod and he . . .

smote them with emerods" (1 Sam. v.) we find not only that the plague is identified with bubonic plague ("emerod" is considered to be a corruption of "hæmorrhoid," and to mean a swelling, which is the outstanding symptom of bubonic plague) but that mice are associated with it. The "trespass offering" which the Philistines had to make before they could be healed was "five golden emerods and five golden mice" which were to be "images of your emerods and images of your mice that mar the land." Again the Lord smote the army of Sennacherib (2 Kings xix. 36) in the seventh century B.C. and mice appear, according to Herodotus, in association with this plague. Whether the connection in this and other instances (the mouse god Smintheus was made responsible for pestilence in the *Iliad*) was accidental or not is a question which has not been finally decided. The known association of the rat with plague makes it a question of tantalizing interest.

Although Hippocrates treats epidemic diseases in large and wise spirit (see page 58) he does not appear to possess the idea that they are infectious and most of the Greek medical writers fail in the same way. The atmosphere ('airs," "miasmas," etc.) is held responsible for spread of disease as the only known cause acting everywhere. Other ancient writers of later times recognized the fact of infection but regarded it as a minor cause. All through the Middle Ages, through the horrors of the Black Death, the one prophylactic measure was purification of the atmosphere whether by fire (Pope Clement VI sat between two great fires at Avignon during the Black Death, a not unreasonable proceeding) or by fumigation with incenses and burnt herbs and an endless variety of aromatic essences.

In the sixteenth century the litterateur, scientist and physician, Girolamo Fracastoro "first opened men's eyes to the nature of contagion" (as a contemporary declared), in a work published at Venice in 1546 of which the third book was entitled *De Contagione et Contagiosis Morbis et Curatione.* Up to this time fevers were classed as "ephemeral," "putrid" and "hectic" and ascribed to corruption of the humours. Fracastoro finally disposed of these superficial views and clearly distinguished both causes and varieties of infection. Dr. Singer says that "at the back of all modern views on infectious diseases lies the work of Fracastoro." His book *De Contagione* contains "three contributions of the first importance—a clear statement of the problems of contagion and infection, a recognition of typhus fever and a remarkable pronouncement on the con-

tagiousness of phthisis."—(*Osler.*) Others before him had expressed somewhat similar ideas but Fracastoro first stated clearly the modern doctrine. The three varieties of infection recognized once and for all in this genuinely scientific work are: (1) infection by contact (contagion is an infection passing from one individual to another and is the same in him whom receives and in him who gives); (2) infection by indirect means, as by a garment, or fomites (Fracastoro invented this term *fomes* which is still the only term used to describe infected articles); (3) infection at a distance.

Moreover, three centuries before bacteriology he outlined the mechanics of infection in his doctrine of *seminaria*, invisible seeds of contagion, or germs. Thus he says:

> These seeds are the carriers of the contagion and that they are the first origin of the disease there can be no doubt.
>
> It may be considered that the force of the disease lies in those seeds since they have the power to propagate and reproduce their own kind.

The conditions of his time undoubtedly helped Fracastoro in his work by providing him with ample material for study. He saw several waves of epidemic disease, including typhus, phthisis, rabies, leprosy and the English sweat. Venereal disease was first recognized in Italy in his youth about 1494, and his study of it produced that extraordinary poetic work, half romantic and half clinical, published in 1530 and dedicated to a Cardinal, entitled *Syphilis sive Morbus Gallicus*, from which the disease was named. After the *Regimen Sanitatis Salerni* it is the best-known and most frequently printed medical poem. Its interest to us, apart from the Virgilian graces of its seventy pages of Latin verse, is threefold. It gave the disease one name instead of the many which then multiplied confusion, it described the symptoms accurately, and thereby distinguished it as a separate disease; and insisted on the virtues of the only two remedies—mercury and guaiacum—which have availed until the discovery of salvarsan, the arsenic compound, in the twentieth century.

It is with a sense of disappointment that we find that, despite the accuracy and clarity of Fracastoro's work on infection, the purely medical methods of combating the great plagues of the sixteenth and seventeenth centuries were no improvement in practice on those of the fourteenth and fifteenth. Until the germ itself was discovered really effective measures to stamp

out the disease were not possible but once the doctrine of contagion was properly laid down it is not unreasonable to expect real effort to prove its efficacy and benefit by it. Perhaps it remained something of a scientific curiosity; it is always difficult for the practical man to believe in the remorseless activity of something unseen. Certainly, with few exceptions, the machinery was inefficient and generally insufficient however harshly at certain times and places segregation was enforced. Notable exceptions are commented on below. Like the poor, plague was always present, and it is probable no town was free from sporadic cases. When the terror struck, i.e. when the mortality rates rose much above the customary, isolation was applied but it was often half hearted and generally too late. Then the flight began from the stricken city and the disease was but carried abroad.

Always plague has followed communications—trade routes, shipping, etc. The great plague of Rome in the second century, described by Galen, was introduced from Syria by the Roman army. The Black Death, perhaps the most appalling visitation of all, was brought from the Near East by a Genoese ship to Messina in 1347, and spread by fugitives all over Sicily and Tuscany by 1348, whence it covered the whole of the rest of Europe. Even Greenland did not escape. There the plague, as Sir Charles Oman has declared, deflected history by wiping out a community which was then in touch with North America and knew the route there one hundred and fifty years before Columbus.

The results in mortality of the Black Death were appalling. Estimates vary from a quarter to more than half of the entire population of Europe for the period 1348–59. According to Guy do Chauliac three-quarters of the people of France died. Germany which suffered relatively lightly is estimated to have lost one million two hundred and forty-four thousand persons.—(*Nohl.*) In England about half the population disappeared, the report from London being that scarcely one in ten survived. In Italy again half the people died, cities like Venice and Florence losing three-quarters of their inhabitants. Boccaccio reports that in Florence with about one hundred and thirty thousand inhabitants more than one hundred thousand died. The consequent misery and horror cannot be adequately described. Boccaccio's own long and dramatic account of the plague as he saw it in the neighbourhood of Florence has often been quoted and need not be repeated here. One poignant paragraph is sufficient to strike the note:

> Now I tell you that extremities running on in such manner little lesse spare was made in the Villages round about; wherein poore Labourers and Husbandmen with their whole Families dyed most miserably in outhouses, yea in the open fields also; without any assistance of physicke or helpe of servants and likewise in the highwayes, or their ploughed landes, by day or night indifferently, yet not as men, but like brute beasts.—(*Translation of* 1625.)

Helpless and unhelped, that is the outstanding fact. Even the best of the physicians declared themselves helpless. Guy de Chauliac, the father of modern surgery and physician to Clement VI, said:

> The disease was most humiliating for the physicians, who were unable to render any assistance, all the more as for fear of infection, they did not venture to visit the patients, and if they did could do no good and consequently earn no fees, for all infected died with the exception of some towards the end of the epidemic, who escaped, as the boils had been able to mature.

The characteristic symptom of plague is the appearance of buboes, or boils, in the lymphatic glands, generally in the groin, though they may appear in the arm-pit or neck. Although the incubation period after infection averages three days, onset of the illness is generally sudden and often severe. The mortality rate under the best conditions is high. These features of suddenness and deadliness struck terror in the minds of men who could have no notion of the actual invisible processes involved. We now know that bubonic plague is due to the *bacillus pestis* which lives in the stomach of a flea, whose host is the rat. Without rats there would be no plague, and it is a fact of sardonic interest that in plague time in seventeenth century London it was the domestic animals, particularly the dog, that were suspected, and rats were neglected while dogs were slaughtered; the rat-catcher turned dog-killer. In one modern plague outbreak in China over twenty thousand dead rats were collected in one city, but this obvious association between rats and plague seems to have escaped notice in earlier days. It will be understood of course that the infection in bubonic plague is conveyed not by the rat, which itself suffers, but by the bite of the infected rat-flea. A modern experiment by Dr. Glen Liston demonstrates the sublety of transmission of the disease. A dead rat was found with six fleas upon it. On the spot where it had died nothing whatever could be seen, but a guinea-pig, known to be completely free of fleas, was allowed

to run over the spot for one minute. When searched no fewer than eighty-two rat-fleas were picked off it, of which a large proportion contained plague bacilli in their stomachs. It is small wonder that our predecessors nearly always failed to control so prolific and persistent an infection.

The pneumonic form of plague, which is often mingled with the bubonic and appears to be due to the same bacillus, is even more virulent. Moreover, instead of passing first through another organism, the rat-flea, it is directly contagious, usually by inhalation from the coughing of an infected person. It sets in abruptly two or three days after infection and few survive as long as two days, many dying in sixteen hours. There is still no known treatment of any avail and all modern efforts are directed towards prevention. Whereas bubonic plague has always tended to die out in cold weather (the murderous flea breeds best in warmth), the pneumonic form flourishes in cold climates when people, especially the poor, are crowded together. In Manchuria in 1910–11 over sixty thousand died of it.

Some attempts to check the spread of plague were partially successful even in the fourteenth century. Venice, for instance, kept the dreaded disease outside its borders in 1370 by vigorous isolation. Though born of panic it was a genuine public health measure. Ragusa went further in 1377, and established an isolation post outside the city, where all suspected persons were detained at first for thirty days and later for forty days, a *quarantina*, whence comes our word for the isolation of medical suspects. In the sixteenth century Paris provides a good example of public hygiene in the *Plague Ordinances* (published by Dr. Charles Singer) which were issued during an outbreak in 1533. Carriage of infected goods is prohibited, all cases of plague must be notified and isolated in the houses concerned, roads are to be kept clean and gutters well flushed, cesspools walled up and after plague corpses have been buried the houses infected are to be emptied and cleansed and marked with crosses.

Similar measures were adopted in the Great Plague of London [Plate 45] though multitudes fled and over sixty-eight thousand died. Plague orders were also issued in the outburst of pneumonic plague forty years earlier when over four thousand a week died in London alone during a cold and wet August. In fact many English plague measures were French in origin. A more scientific attitude is at this time adopted, and it is possible for Defoe, writing in 1702, to suggest that, instead of divine wrath and astrologic arrows, the cause may be due to the

multiplication of minute organisms. In the last great European plague, that of Marseilles and Toulon in 1720, when ninety thousand lives were lost, drastic quarantine prevented further spread.

The plague doctors of Marseilles are represented in many prints garbed in long gowns and masked hoods, carrying tapers, a costume that, queer and even ludicrous as it may seem, is not dissimilar to that necessarily adopted by the twentieth century attendant on pneumonic plague cases. He, too, wears a mask filtering all inhaled air, rubber gloves and long boots and goggles to protect the eyes [Plate 46]. The views of the famous Dr. Mead on sanitation in plague time are referred to in a later page.

The part that medicine has played in the fight against this worst of all man's enemies was, in earlier days, of less importance than that played by hygiene; even now it is overshadowed by bacteriology.

The disease which, after plague, attracted most attention in the medieval world was leprosy. This was, in part, because attention was drawn to it by its description and detailed regulation in the Old Testament and also because of obvious indications of its steady increase. By the sixth century it was spreading through France. Here it was the Church which took action because the authority for action was derived from Holy Writ. Although leprosy is definitely contagious (the lepra bacillus can be transmitted by direct contact as well as by fomites) yet it is less easily transmitted than nearly all other chronic infections, and it is characteristic of the mental attitude of the early Middle Ages that the only public measures adopted in attacking disease were those applied to the disease described in Leviticus xiii. and xiv. However, they had their effect in time in driving home the idea of general contagion.

The first action was the strict limitation of leper movement by the Edict of Lyons in 583. Other ecclesiastical ordinances based on Leviticus followed and a general system of prevention was gradually elaborated. The leper was banished from all social life and with solemn ceremony declared civilly dead, condemned to associate only with fellow sufferers until physically dead. Even so his manner of life was narrowly restricted. He could not go barefooted on the highways, he had to announce his presence by horn or rattle and to wear warning signs on his clothes. Leper-houses and leper-colonies were established which, at the height of the infection, had about twenty thousand occupants. By a rigid system of inspection and exclusion which

PLATE XLV

Scenes in the Great Plague of 1665

The set of woodcuts in this broadside of 1665 or 1666 appeared in various forms, some close copies, for several years after the Great Plague. In the first cut the plague sick receive attention, with a coffin ominously in the foreground: in the second, the rat-catchers, by a most unfortunate ignorance of the source of infection, have turned dog-slayers (*see* page 126): in the third, fourth, sixth and last are scenes of flight by land and water from the stricken city. The remainder show the disposal of the dead.

From Walter G. Bell, "The Great Plague in London in 1665."

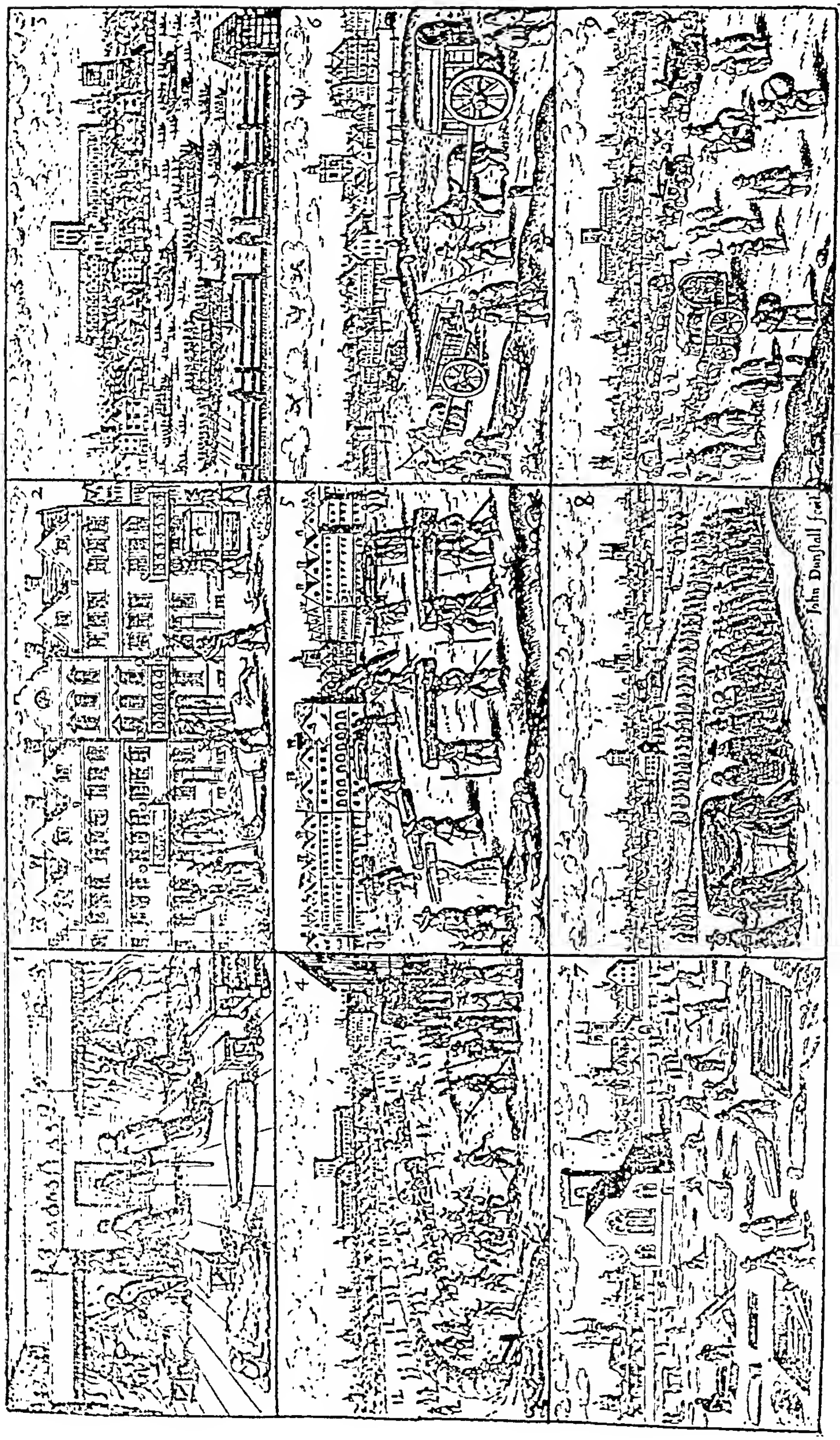

John Dunstall fecit

Plate XLVI

PLATE XLVI

Plague Doctors in the Seventeenth and Twentieth Centuries

By the early seventeenth century it had been clearly recognised that plague infection could and did cling to clothing, and the person and the plague doctor adopted the sufficiently reasonable costume, curious in appearance, shown on the left-hand figure. Protection, though not complete, was probably fairly good, provided cleanliness was maintained. The long peaked nose covering was stuffed with aromatic substances. It was certainly realised that the deadly infection could be projected through the air on moisture from the sick man's breath or cough.

His completely protected modern successor is seen on the right. This was the costume adopted with success by the Japanese in the virulent epidemic of pneumonic plague in Manchuria in 1909–10.

in the end became non-ecclesiastic, Europe was practically freed in the course of centuries from this contagion. It is not unknown in modern times in certain coastal districts of Northern Europe, but otherwise is extinct in the West although it remains common in the East, in South Africa and in the tropics. An average of six hundred patients are segregated on Robben Island near Capetown. The modern treatment by injection with chaulmoogra oil and its derivatives has produced a number of cases of cure. Chaulmoogra has been known as an antidote since 1500 B.C., but its use has always been limited by the bad effects on the liver when given medicinally in the large doses necessary.

Like leprosy and the plague other diseases, which in earlier times were serious enemies of the Western world, have retreated to other parts and are now regarded as essentially tropical. These include malaria, dysentery and typhus fever. The second cannot be brought within the scope of this very brief survey and the third is referred to in Chapter XVI. The first was, until the late nineteenth century, extremely common in most districts of England. References to it as ague are found in very many sixteenth, seventeenth and eighteenth century writers. The great Sydenham owed something of his renown to his treatise on the subject. The epidemics of ague of the sixteenth to eighteenth centuries were due, particularly in England, to ill-drained swamps where the malaria mosquito bred freely and where it continued to breed freely for over three centuries. Dr. Singer points out that in St. Thomas's Hospital, London, between 1850 and 1860 more than one-twentieth of the patients were cases of ague, a disease which we now rightly regard as tropical. Drainage works carried out in London and the country after that date resulted in the disappearance of the disease, and a careful search for a native case of malaria at the beginning of the twentieth century produced only one example.

Malaria has been a constant enemy from very early times. In the varying forms which we know it was a scourge in Hippocrates' day (as we have noted) and some authorities are disposed to credit it with an important part in the destruction of the ancient Greek civilization. Although it was banished from this country eighty or more years ago it is still endemic in many parts of Europe. It is only fifty years since the blood parasite which causes the disease was discovered by Laveran and little over thirty since Sir Ronald Ross proved its transmission by one variety of mosquito (*anopheles*). Sir Patrick Manson, who

first made the suggestion that led to the incrimination of the mosquito, confirmed the conclusions of Ross by experiment in the malaria districts of the Campagna. The double life-cycle of the parasite in the stomach and salivary gland of the mosquito and in human blood is so elaborate that its determination is a biological achievement of a very high order. Since the cause of the disease has been established preventive measures against the insect pest responsible have made large areas of the tropics healthy and inhabitable to a degree beyond all possibility forty years ago.

The ever famous campaign of General Gorgas against mosquito borne disease in the Panama Canal area has shown that hygienic organization can control devastating disease. The outstanding triumph at Panama was the elimination of yellow fever, a virulent epidemic disease transmitted by another mosquito (*stegomya*). As a result it is now restricted to the West coast of Africa and a few places in South America.

A sixteenth-century medical professor of Leyden, Peter Forest, included in his *Observations* another epidemic disease from which, unfortunately, none of the modern world is yet free. We quote Dr. Withington's translation:

> *Epidemic catarrh at Delft*, 1580: At the end of June and throughout July epidemic catarrhs spread *publice ac catervatim* throughout the neighbourhood. They were of sudden onset, very contagious, accompanied with fever, and inflammation of the throat and lungs, with hoarseness and coughing, so that whole families were suddenly struck down thereby; but the disease was not very dangerous, and many easily escaped by immediate bleeding and gentle purgatives, though in some it passed on to peri-pneumonia, and others had severe pleurisy. This febrile epidemic raged not only here but throughout France and Germany, and came to us *afflatu quodam* from those regions. After July it decreased, but revived in the autumn when many recovered without bleeding; but in winter the catarrhs were worse, with bloody sputa and pleuritic pains.

In this we are to recognize the protean disease called by the Italians of the seventeenth century "the influence" because they ascribed it to the influence of the stars. The French name "La Grippe" appears about 1743. Huxham described it in England as "influenza" in 1750. Partly because of its protean nature (a medical authority states that it occurs in so many various forms that it is often difficult to say whether features of an individual case are complications or belong to the disease proper), and also because of the difficulty in earlier days of

distinguishing it from other "catarrhs" and bronchial affections, we do not hear as much of it in records before the sixteenth and seventeenth centuries as the severity of later epidemics might lead us to expect. After the epidemic of 1580 described above, there was one in the seventeenth century, six in the eighteenth and four in the nineteenth up to 1847, and then a long interval of quiescence. Its bacteriological cause is not yet known, although several microbes have been found guilty of association with it. Of its vicious capacities the two world epidemics of 1889-90 and 1918-19, particularly the latter, gave cruel evidence. In fifteen months from October, 1889, the disease traversed the entire globe and it was estimated that from thirty to ninety per cent. of the various populations was attacked. In seven countries of Europe alone in 1918-19 there died one million four hundred and forty thousand and those mainly persons of robust health and youth. If the six million deaths in India be added the total exceeds all those killed in the whole four years of the Great War. Over three thousand died in London in one week in October, 1918. Europe has seen nothing worse since the Black Death nearly six centuries back.

The horrors of large-scale infection need not be laboured; it remains that disease, and epidemic disease in particular, has always been and yet is the worst enemy of man. And so having very briefly surveyed this long story of pity and terror, of achievement and failure, we will resume our sequence in the centuries we have hastened over and turn to the relatively quiet days of the seventeenth century where we see the beginnings of a scientific enquiry that was to do much for the true enlivening of medical thought. This science first manifests itself in a spirit of superior curiosity such as attracted together those eager minds that founded the Royal Society.

CHAPTER XI

SCIENCE IN THE SEVENTEENTH CENTURY: THE ROYAL SOCIETY, SANCTORIUS AND HARVEY

It is a remarkable fact that the space of a century, which mankind has accepted as a convenient measurement of time, usually answers perfectly to that artificial limit by assuming a particular quality or colour in the mind of the student. It is impossible to confuse the fifteenth century with the sixteenth century, the seventeenth with the eighteenth. In tracing the development of medicine and the evolution of ideas of hygiene, it will be well if in considering our next period we can fix on some great figure or movement to sum up the quality of the time.

The special virtue or quality of the seventeenth century was the birth of modern physiology, and it is usual to begin accounts of this epoch by recording the discovery of the circulation of the blood by William Harvey.

For our present purpose it will, perhaps, be better to forsake strict chronology for a few years, and to note a profoundly important weekly event that was taking place in London about the year 1645, "sometimes at Dr. Goddard's lodgings, sometimes at the Mitre in Wood Street hard by." A few young men met weekly "at a certain day and hour, under a certain penalty, and a weekly contribution for the charge of experiments, with certain rules agreed upon amongst us." In these words does John Wallis, himself afterwards a great mathematician, record the inception of the first concerted movement in England towards the study and discussion of Natural Philosophy. "We barred," he continues, "all discourses of divinity, of State-affairs, and of news (other than what concerned our business of Philosophy), confining ourselves to philosophical inquiries, and such as related thereunto; as Physick, Anatomy, Geometry, Astronomy, Navigation, Staticks, Mechanicks, and Natural Experiments."

The other chief members of this small private club were John Wilkins, afterwards Bishop of Chester; Jonathan Goddard, a noted physician, still remembered by his remedy, Goddard's

Drops; George Ent, a physician, afterwards knighted, and friend and executor of the great Harvey; Francis Glisson, who was to write a classic work on the rickets; Charles Scarbrough, also later on to be knighted, and to attend Charles II in his last illness; and Christopher Merrett, who became first librarian of the collection of books which Harvey gave to the College of Physicians. It will be observed that the bias of this company was medical. But as yet its members were young (the average age being thirty-four), and they met each week to discuss scientific subjects in a new way. The meetings were removed, soon after, to the Bull's Head in Cheapside, or to Gresham College.

In 1648 the man who was probably the most versatile of the little band was appointed Warden of Wadham College, Oxford. This was John Wilkins, a man of immense learning and great originality of mind, who besides being interested in a possibly habitable world in the moon, and in a universal language, made experiments while he was at Wadham in the art of flying. Let us listen for a moment to what a young disciple of his, Robert Hooke, wrote of this man a quarter of a century later:

> If these my first Labours shall be any wayes useful to inquiring men, I must attribute the incouragement and promotion of them to a very *Reverend* and *Learned Person*, of whom this ought in justice to be said, *That there is scarce any one Invention, which this Nation has produc'd in our Age, but it has some way or other been set forward by his assistance.* My reader, I believe, will quickly ghess, that it is *Dr. Wilkins* that I mean. He is indeed a man born for the *good* of *mankind*, and for the *honour* of his *Country*. In the *sweetness* of whose *behaviour*, in the *calmness* of his *mind*, in the *unbounded goodness* of his *heart*, we have an evident Instance, what the true and the *primitive unpassionate Religion* was, before it was *sowred* by particular *Factions*. In a word, his *Zeal* has been so *constant* and *effectual* in advancing all good and profitable *Arts*, that as one of the Antient *Romans* said of *Scipio*, *That he thanked God that he was a* Roman; *because whereever* Scipio *had been born, there had been the seat of the Empire of the world:* So may I thank God, that *Dr. Wilkins* was an *Englishman*, for whereever he had lived, there had been the chief Seat of *generous Knowledge* and *true Philosophy*. To the truth of this, there are so many worthy men living that will subscribe, that I am confident, what I have here said, will not be look'd upon, by any ingenious Reader, as a *Panegyrick*, but only as a *real testimony*.

It is not surprising that young men, wearying of the theological disputes of their fathers and the dust of civil war, grouped

themselves round this remarkable man in order to discuss subjects more directly of importance to the progress of mankind. The meetings begun at the Mitre were continued in Dr. Wilkins's lodgings at Wadham, or at Dr. Petty's lodgings in Oxford "because of the conveniences we had there (being the house of an apothecary) to view, and make use of, drugs and other like matters, as there was occasion."

Perhaps no group of names possesses more meaning for the birth of the modern spirit in science than the names of Dr. Wilkins's young men. "The principal and most constant of them" were Seth Ward, first an astronomer, and afterwards Bishop of Exeter, and then of Salisbury; the Honourable Robert Boyle, our first great chemist; William (afterwards Sir William) Petty, soon to be Cromwell's First Physician to the Army in Ireland, and ultimately our first political economist; Matthew Wren, son of the Laudian Bishop of Ely, and cousin to the architect of St. Paul's; John Wallis; Jonathan Goddard; Thomas Willis, a physician who was occupied in researches on the brain and nervous system; Ralph Bathurst, a physician who became also Dean of Wells; Laurence Rook, an astronomer who died at the early age of thirty-nine; and the greatest genius of them all, the young anatomist Christopher Wren, who had come up to Wadham presumably, as Sir Lawrence Weaver points out, to be under the influence of Wilkins. The object of these men was "a free way of reasoning", and

> "their first Purpose was no more than only the Satisfaction of breathing a freer Air, and of conversing in Quiet one with another, without being ingag'd in the Passions and Madness of that dismal Age. . . . To have been always tossing about some *Theological Question*, would have been, to have made that their private Diversion, the Excess of which they themselves dislik'd in the publick: To have been eternally musing on *Civil Business*, and the Distresses of their Country, was too melancholy a Reflexion: It was *Nature* alone, which could pleasantly entertain them in that Estate."
>
> "And," continues their first historian, Bishop Sprat, "from the Institution of that *Assembly*, it had been enough if no other Advantage had come but this: That by this means there was a Race of young Men provided against the next Age, whose Minds receiving from them their first Impressions of *sober* and *generous Knowledge*, were invincibly arm'd against all the Inchantments of *Enthusiasm*".

They took the whole of Natural Science for their field, and gradually moulded their meetings into a clearing-house for scientific information. Meanwhile it is of importance for the purpose of this book to note that those members of the circle

whose interests were medical were constantly busy dissecting or performing experiments on living animals, and that there grew up an Oxford school of physiology which, in a golden period of fifty years, entirely changed the course of medical knowledge, and turned its stream from the arid desert of medieval theory into the rich fields of experiment. For the moment it will be sufficient to remember that among the names of these young Oxford physiologists were Christopher Wren, Robert Boyle, Robert Hooke, Richard Lower, John Mayow, Francis Glisson, and Thomas Willis.

The meetings were continued at Oxford till about the year 1658, by which time certain of the members had removed to the larger world of London. The Restoration came in 1660, and it will ever be to the honour of a king not always credited with the more dignified qualities of kingship that in 1662 Charles II consolidated the status of the society by giving it a Royal Charter. Thus was born The Royal Society of London.

It cannot be too clearly emphasized that it was by the method of experiment and the gradual registering of facts that the new Society was to be useful to mankind. There was to be no dogmatizing, but only the acceptance of data, until such time as any new fact or evidence arrived to disturb or set aside the first conclusion. This is the true method of science, and it was in England in the seventeenth century that the theory first became the accepted instrument of knowledge. The new Baconian philosophy was bearing its fruit in action, and it is significant that when John Evelyn, the diarist, came to design a symbolical frontispiece for the First Edition of Sprat's *History of the Royal Society*, 1667, the figure of Francis Bacon was prominent in it [Plate 48].

But now, having set the stage for the modern era of medical science in England, we must leave it for a few moments for Padua, to witness there an interlude which exhibits in a surprising flash the birth of the modern method of research. The middle ages are dead, and there is no "*Vive le moyen âge.*"

Sanctorius Sanctorius (1561–1636) was Professor of Theoretical Medicine at Padua. The great Galileo was also at that university, and it was clearly from Galileo's influence that Sanctorius conceived the idea of applying exact measurement to the hitherto elusive functions of the body.

Sanctorius constructed a weighing-chair, a chair attached to a balance, by which he could contrast the difference in his own weight before and after a meal, before and after sleep, and under other varying conditions. He distinguished between sensible

and insensible perspiration. Sensible perspiration comprised the several normal evacuations of the body, but by insensible perspiration he designated the processes of which we are unconscious, and to estimate these by variations in weight Sanctorius spent the best part of thirty years in his weighing-chair. At times he even slept in it.

In one of his aphorisms he says:

> "That is the most proper time of Eating, wherein the Body comes to some healthful Standard, as it enjoyed the Day before, when empty: But that *Apollo* himself cannot find out, without the Ballance"

This method of research does seem rather to preclude a sense of humour, and one wonders a little what the poets would say to it.

But Sanctorius, by his devotion, laid the foundation of the modern science of metabolism, and it is in recent times that his work has borne most fruit, so that we have an interesting example of an isolated train of research, instinct with the modern spirit, considerably written about in the century following the author's death, but without recognition of its practical importance, and ultimately coming to life again in our own day. He was well aware that he had initiated a new method of inquiry in medicine, as will be seen from Sir Michael Foster's translation of Sanctorius' preface to his book:

> It is a new and unheard of thing in Medicine that anyone should be able to arrive at an exact measurement of insensible perspiration. Nor has anyone either Philosopher or Physician dared to attack this part of medical inquiry. I am indeed the first to make the trial, and unless I am mistaken I have by reasoning and by the experience of thirty years brought this branch of science to perfection, which I judged more advisable than to describe all the details of my inquiry.

Sanctorius published the results of his researches in a book, called *De Statica Medicina*, at Venice, in 1614. It consists of nearly five hundred short aphorisms, divided under the headings of Insensible Perspiration, Air and Water, Meats and Drink, Sleep and Watching, Exercise and Rest, Affections of the Mind, and what the seventeenth century called Venery. It is from the English translation of John Quincy (Fourth Edition, London, 1728) that we give a few examples of Sanctorius' aphorisms. Some have been chosen to exhibit the results of his experiments

PLATE XLVII

Signatures of Charles II and the Duke of York in the Charter Book of the Royal Society

On the 9th of January, 1665, The Royal Society received their Charter, and the King and the Duke of York signed their names at the head of the Charter Book. The King signed himself "Founder" and the Duke of York "Fellow". The Duke of Albemarle (George Monk) entered his name at the same time. The president, Lord Brouncker, so often mentioned by Pepys, then kissed the King's hand in recognition of the honour conferred on the Society. At the meeting of the Society on the 11th of January, the book was produced.

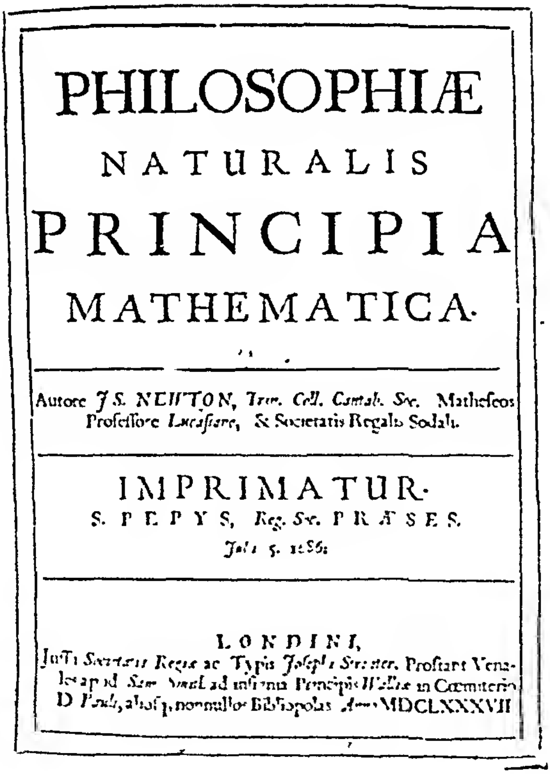
Pepys happened to be at Whitehall on the day of the signing, and his account brings us very near to the event: Jan. 9: "Up and walked to Whitehall, it still being a brave frost, and I in perfect good health, blessed be God! In my way saw a woman that broke her thigh, in her heels slipping up with the frosty street. To the Duke, and there did our usual worke. Here I saw the Royal Society bring their new book, wherein is nobly writ their charter and laws, and comes to be signed by the Duke of York as a Fellow; and all the Fellows' hands are to be entered there, and lie as a monument; and the King hath put his with the word Founder. Thence I to Westminster, to my barber's, and found occasion to see Jane, but in presence of her mistress, and so could not speak to her of her failing me yesterday, and then to the Swan to Herbert's girl, and lost time a little with her, and so took coach, and to my Lord Crew's and dined with him, who received me with the greatest respect that could be".

From "The Universal History of the World".

Title-Page of the First Edition of Newton's "Principia," 1687

The book was published by the Royal Society, and Pepys, as President, licenced it for publication. He had been elected President on the 1st of December, 1684, and his association with one of the two or three most important books in the history of science emphasizes that aspect of him which is farthest from the popular view of this great public official. In his later life he corresponded with Newton.

British Museum.



PHILOSOPHIÆ
NATURALIS
PRINCIPIA
MATHEMATICA.

Autore *JS. NEWTON*, *Trin. Coll. Cantab. Soc.* Matheseos Professore *Lucasiano*, & Societatis Regalis Sodali.

IMPRIMATUR.
S. PEPYS, *Reg. Soc.* PRÆSES.
Julii 5. 1686.

LONDINI,
Jussu *Societatis Regiæ* ac Typis *Josephi Streater*. Prostant Venales apud *Sam. Smith* ad insignia Principis *Walliæ* in Coemiterio D. *Pauli*, aliosq; nonnullos Bibliopolas. *Anno* MDCLXXXVII.

Plate XLVIII

PLATE XLVIII

FRONTISPIECE OF THE FIRST EDITION OF SPRAT'S "HISTORY OF THE ROYAL SOCIETY", 1667

This plate was designed by John Evelyn, the Diarist, and was engraved by Wenceslaus Hollar, and was prefixed to some copies of the First Edition. In the centre is a bust of Charles II. On the left is the first President, Lord Brouncker, and on the right Francis Bacon. At the top of the picture are the arms of The Royal Society.

Sprat's book was first published in 1667, and there were subsequent editions in 1702, 1722, and 1724. Cowley contributed an Ode to The Royal Society, and the book may be read to-day as a fine example of English prose just settling down to the classic virility of the age of Dryden. Thomas Sprat (1635–1713) was Bishop of Rochester and Dean of Westminster.

in insensible perspiration, but others are of more general interest in connection with questions of health. All are the work of an acute and probing mind.

Sect. I

OF INSENSIBLE PERSPIRATION, AS IT APPEARS BY WEIGHT

Aph. 1. If there daily be an Addition of what is wanting, and a Substraction of what abounds, in due Quantity and Quality, lost Health may be restor'd, and the present preserved.

Aph. 2. If a *Physician*, who has the Care of another's Health, is acquainted only with the sensible Supplies and Evacuations, and knows nothing of the Waste that is daily made by insensible Perspiration, he will only deceive his Patient, and never cure him.

Aph. 3. He only who knows how much, and when the Body does more or less insensibly perspire, will be able to discern, when, and what is to be added or taken away, either for the Recovery or Preservation of Health.

Aph. 4. Insensible Perspiration alone, discharges much more than all the servile Evacuations together.

Aph. 5. Insensible Perspiration is either made by the Pores of the Body, which is all over perspirable, and cover'd with a Skin like a Net; or it is performed by Respiration through the Mouth, which usually, in the Space of one Day, amounts to about the Quantity of half a Pound, as may plainly be made appear by breathing upon a Glass.

Aph. 6. If eight Pounds of Meat and Drink are taken in one Day, the Quantity that usually goes off by insensible Perspiration in that Time, is five Pounds.

Aph. 9. If the Body encreases beyond its usual Weight, without eating or drinking more than customary, there must either be a Retention of some of the sensible Excrement, or an Obstruction of the perspirable Matter.

Aph. 17. A Person may certainly conclude himself in a State of Health, if upon ascending a Precipice he finds himself more lightsome than before.

Aph. 21. That Perspiration which is beneficial, and most clears the Body of superfluous Matter, is not what goes off with Sweat, but that insensible Steam, or Vapour, which in Winter Time exhales to about the Quantity of fifty Ounces in the Space of one natural Day.

These are all extraordinarily modern statements for the year 1614 when Avicenna was still being taught in the medical schools of Europe. It is a great pity that Sanctorius did not record the methods but only the results of his experiments.

Sect. 1.

Aph. 55. Too thick Apparel hinders Perspiration, by wasting the Spirits.

Aph. 123. A Person may happen upon such a Way of living, even when he takes no Care about it, as may preserve him to a good old Age.

Aph. 139. (Of the Plague). Very few of the Wealthier people are cured by Medicines, but a great many of the poorer Sort recover without them.

Sect. 4.

OF SLEEP AND WATCHING

Aph. 2. With seven Hours sleep the Body insensibly perspires, and without any Trouble, twice as much as when awake.

Aph. 25. Changing a Bed occasions disturbed Sleep, and lessens Perspiration; for an unaccustomed Place, although better than before, disturbes both the Body and Mind.

If Sanctorius could eliminate the boredom of the weighing-chair he would be Nature's best philosopher.

While it is true that Bacon was the turning influence in this country that led to the clearing of men's minds, and to the forsaking of the dogmas and mysticism of the Middle Ages, for the real world of experiment and the correlation of knowledge, it is now necessary to go back from the London and Oxford of the Restoration, and to record that in 1578 there had been born at Folkestone, just seventeen years after Bacon himself had been born, a man who was not only one day to be Bacon's physician, but who was to do for physiology, and by means of it for medicine, as much by actual experiment and proof as Bacon did for natural science by precept.

William Harvey (1578–1657) was the discoverer of the circulation of the blood, and it is for this reason that no biographical fact concerning his life is without interest. He was born of prosperous yeoman stock at Folkestone in 1578 and went to school at Canterbury. From there he went to Cambridge, where at Caius he graduated in Arts, and then, choosing the profession of medicine, he proceeded at the age of twenty-one to study it at the famous medical school at Padua.

Through Harvey's selection at Padua, chance or destiny brought him to the well-spring of modern anatomy, and to the clue which set his mind on the track of his shining discovery.

Vesalius, Professor of Anatomy at Padua, had laboured there

for five years, and by the publication of his *Fabrica* (1543) became the true founder of modern anatomy and physiology. When Vesalius left Padua his duties were entrusted for a short time to a deputy, Matheus Realdus Columbus, but in 1551 Vesalius's chair was given to Gabrielus Faloppius, his devoted pupil. Faloppius in turn was succeeded in 1565 by his own pupil Hieronymus Fabricius of Aquapendente, and it was during this excellent man's reign as professor of anatomy that Harvey came to study medicine at Padua. It will thus be seen that the young Harvey, as were very many other young men, was in daily contact with the great Vesalian tradition. The Englishman from Kent alone carried it to its exquisite logical conclusion.

Harvey, then, came to Padua, where he found the legend of Vesalius in active flower, and it is worth remembering at this point that his master, Fabricius, had paid special attention to the valves of the veins, and four years before Harvey was born had discovered, in 1574, what he later called, in his book *De Venarum Ostiolis*, 1603, "the little doors of the veins" [see Plate 50].

Harvey remained at Padua for four years, till in 1602, he received the degree of Doctor of Medicine and returned to England. He settled in London, became a Fellow of the College of Physicians in 1607, and was appointed physician to St. Bartholomew's Hospital in 1609.

In 1615 Harvey was appointed Lumleian Lecturer by the College of Physicians, an appointment which entailed public lectures on subjects connected with the human body. In April, 1616, he began to give these lectures, and from his own manuscript notes for them, which are still in existence, it is known that at the very commencement, during the second day lecture, he began to bring forward new views on the movements of the blood and heart. He had certainly made good use of the thirteen years since he left Padua, for by dissection and vivisection, inference and reasoning, and by the final touch of that fire which we call genius, he had been enabled to arrive at a point of knowledge which definitely divides the new world of physiology from the old.

But even now he "studied to be quiet", and was in no hurry. He went on for some years attending his patients and lecturing and proving by experiment the truth of his theory. It is known that he dissected at least eighty species of animals, and by his system of research and observation and checking and reasoning he came to that position of impregnable argument which at last

he published to the world in his book *Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus* (Frankfurt, 1628).

Why, it may be asked, had not the circulation of the blood been discovered before, and what exactly is the circulation of the blood, and what led Harvey to the special study of the subject?

From early times it had been observed that in some sense the blood moved. Aristotle had had his teaching concerning the movement of the blood, and Galen had elaborated a theory about it which lasted as a false sign-post for centuries. But all this was mere vagueness about some minor desultory and local ebb and flow. Towards the end of the Middle Ages some light began gradually to break, and Vesalius, Servetus, Cæsalpinus, Columbus, and Fabricius had all made some contribution to the subject.

The circulation of the blood had not been discovered before Harvey's time, because the method of physiological observation by vivisection, dissection, and experiment was in its childhood. It was the genius of Harvey that seized on the new instrument, moulded it to his needs, and by long years of applying it to the motions of the heart and blood at the same time perfected a method and proved a theory.

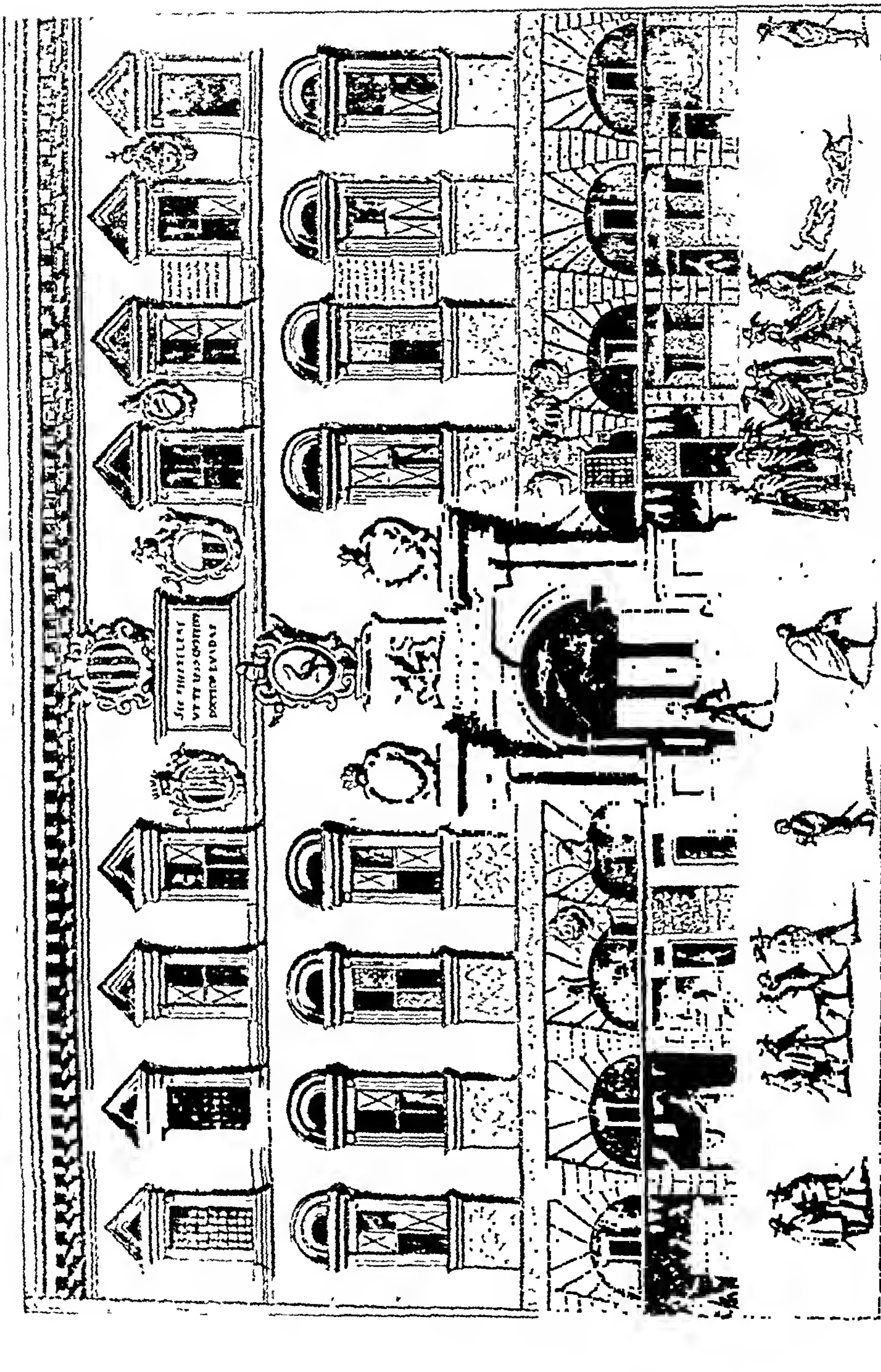
We tread on perilous and debated ground if we try to fix too dogmatically on what it was that first led Harvey to his discovery, but it is at least allowable to repeat that his master Fabricius of Aquapendente published a book on the Valves of the Veins in 1603, and it is difficult, in the light of a conversation which Boyle had with Harvey late in life, not to believe that it was the teaching of his old master at Padua that first set Harvey musing on the motion of the blood. This is what Boyle says:

> And I remember that when I asked our famous *Harvey*, in the only Discourse I had with him, (which was but a while before he dyed) What were the things that induc'd him to think of a *Circulation of the Blood?* He answer'd me, that when he took notice that the Valves in the Veins of so many several Parts of the Body, were so Plac'd that they gave free passage to the Blood Towards the Heart, but oppos'd the passage of the Venal Blood the Contrary way: He was invited to imagine, that so Provident a Cause as Nature had not Plac'd so many Valves without Design: and no Design seem'd more probable, than That, since the Blood could not well, because of the interposing Valves, be sent by the Veins to the Limbs; it should be Sent through the Arteries, and Return through the Veins, whose Valves did not oppose its course that way.—(*Disquisition About the Final Causes of Things*, 1688.)

PLATE XLIX

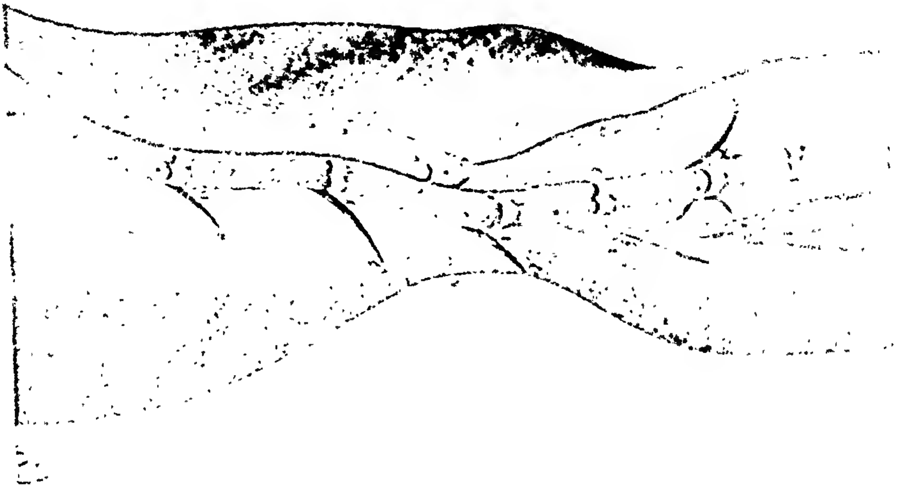
Padua University: Front of the Building Called the Gymnasium

This shows a portion of the University as Harvey knew it, and it may be seen, little altered, to-day. In the rooms within this building he listened to those lectures which set him on the road to the basic discovery of modern physiology. The engraving is dated 1623. Note the shops on the ground floor in the front portion of the University building.



GYMNASIVM PATAVINVM

PLATE L.



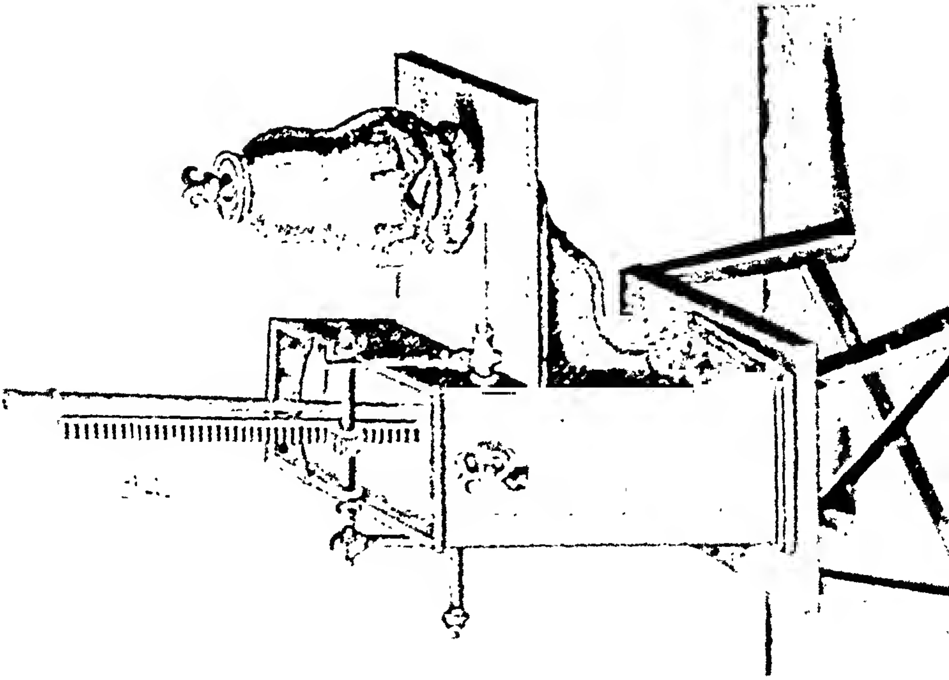


PLATE L

Fabricius' Diagram of the Venous Valves

Hieronymo Fabrizio (1537–1619), or Fabricius of Aquapendente, was anatomical lecturer at Padua when Harvey studied there, and it was he who turned Harvey's attention to the study of the blood vessels. The engraving from Fabricius' *Opera Omnia Anatomica et Physiologia*, Leipzig, 1687, displays the valves in the principal vein of the leg.

An Experiment of the Hon. Robert Boyle

Extraordinary as it may seem, it needed the experimental proof of Boyle, one of the most original and truly scientific minds of those early days of The Royal Society, to show that air was essential to animal life. In this plate from the 1725 edition of his *Philosophical Works* the vacuum pump which he invented shows his demonstration of this fact.

It is not the function of this book to demonstrate physiological processes, but rather to point to the current ideas concerning them, and to emphasize the influence of those ideas on fresh achievements in medicine. But it must be explained that what Harvey proved was that the heart is a pump, a muscular pump, that forces the blood into its circulatory course, and that to support his theory he also used the quantitative argument, that the smallness of the capacity of the vessels of the heart makes it impossible that it can be other than the *same* blood which goes and returns, and goes and returns again. To this must be added the words of Sir Michael Foster:

> The essential feature of Harvey's new view was that the blood through the body was the same blood, coursing again and again through the body, passing from arteries to veins in the tissues, and from veins to arteries through the lungs, heart, suffering changes in the substance and pores of the tissues, changes in the substance and pores of the lungs. The new theory of the circulation made for the first time possible true conceptions of the nutrition of the body, it cleared the way for the chemical appreciation of the uses of the blood, it afforded a basis which had not existed before for an understanding of how the life of any part, its continued existence and its power to do what it has to do in the body, is carried on by the help of the blood. And in this perhaps, more than its being a true explanation of the special problem of the heart and the blood vessels, lies its vast importance.

After the publication of his great discovery Harvey turned his attention to the problems of embryology and generation, and published in 1651 his *Exercitatio de Generatione Animalium*. In this he got probably as far as he could without the aid of the microscope, but he does not attain to the finality of the *De Motu Cordis*.

During these years England had been distracted by civil war. Harvey was physician to Charles I, and was present at the battle of Edgehill, where he was in charge of the two young princes, and retired with them to the shelter of a hedge, "and tooke out of his pockett a booke and read; but he had not read very long before a bullet of a great gun grazed on the ground neare him, which made him remove his station." He was with the Court at Oxford, and remained there for three years, and it is amusing to remember, now that the needs and fame of St. Bartholomew's Hospital are daily before our eyes, that that great foundation, while Harvey was absent, was in half a mind to dispense with her famous physician because he "hath with-

drawn himself from his charge, and is retired to the party in arms against the Parliament."

For the rest it need only be said that Harvey was a munificent patron of learning, and a devoted son of the College of Physicians. While he was yet alive he built for the College a noble library, with a great parlour underneath, and filled the library with rare books, and he made over to the College his estate at Burmarsh in Kent.

The publication of Harvey's book on the Circulation caused tremendous controversy, and he had his enemies and detractors, as he has had in even more recent times. Their favourite method was to ascribe the knowledge of the circulation either to the ancients, or to one or other of the earlier Italian anatomists.

We cannot conclude this account of Harvey better than by quoting a noble sentence from Joseph Glanvill's *Plus Ultra: or, The Progress and Advancement of Knowledge since the Days of Aristotle*, 1668. Glanvill was the writer in one of whose other books, *The Vanity of Dogmatizing*, Matthew Arnold found the story of the Scholar Gipsy. But here is what Glanvill, his late contemporary, says of Harvey: "And therefore here I am no otherwise concerned, but to have *Justice* for that Excellent Man: And the World hath now done *right* to his *Memory*, *Death* having overcome that *Envy* which *dogs living Virtue* to the *Grave;* and his *Name* rests quietly in the Arms of *Glory*, while the *Pretensions* of his *Rivals* are *creeping* into *darkness* and *oblivion*."

CHAPTER XII

NEW SCHOOLS OF THOUGHT: CHEMISTRY AND MATHEMATICS IN MEDICINE

MEANWHILE on the Continent there were springing up two main influences or branches of seventeenth-century medical thought. They came into being contemporaneously with the enormous advances in physiology in this century, and it is interesting to observe one of them at first trying to come to some terms with the thought of the Middle Ages, while the other struck out on an entirely new line. For the sake of perspective, it will be more helpful here to try to consider both movements as current modes of thought rather than by a string of names to leave an imperfect impression of masters and waning disciples.

The first, the more conservative tendency, was that known by the name of the Iatro-chemical School. It had its origin in the work of Paracelsus (1493–1541), whom we met in a previous chapter. But now, early in the seventeenth century, the strongly chemical element in the teaching of Paracelsus was taken up, refined, and expanded into a more rational system by Jean Baptiste van Helmont (1577–1644), who was born at Brussels in 1577. He practised as a physician at Vilvorde, near Brussels, and it is to his thought, tempered by the influence of the Vesalian school of physiology, that we owe the inception of a new science, that of the chemistry of physiology. He evolved a theory of ferments, by which he explained the inner chemical workings of the body, especially of the functions of digestion, and he uses finally the vivid analogy of "the kitchens of the several members," and refers to the fact that a "ferment innate in each place cooks its food for itself."—(*Foster*.) "In the language of to-day," says Sir Michael Foster, "all the tissues live upon the common blood, and the power of assimilation lies in the tissue itself."

But Helmont adapted to all this the relics of medievalism by also carrying forward the Paracelsean presiding genius, the Archæus, or series of archæi, who were inherent in and presided

over the various ferments of the body. A disturbance of the particular archæus caused that archæus to disturb the ferments over which it presided, and illness was the result. The whole doctrine was at once a harking back to the mystical and a reaching forward to modernity.

Then again, Helmont at a leap, by his discovery of a new element, and by his naming it *Gas*, introduced a new principle to the structure, and a new word to the language, of modern science. His "gas" was carbon dioxide or carbonic acid gas.

He was not so illuminated, however, when he gave the name *Blas* to his Archæus or series of archæi. The whole system was presided over by a sensitive motive soul (*anima sensitiva motivaque*) which resided in the pit of the stomach. The profound importance of Helmont is that he began to have some real apprehension of the chemical processes of the body, especially of the functions of digestion, nutrition, and assimilation.

It is obvious that matters could not stand at the half mystical and half chemical stage at which Helmont left them. Like Paracelsus, Helmont in turn had his disciple, and his name was François de la Boe (1614–72), usually known as Franciscus Sylvius. He was born at Hanover, and in 1658 he became Professor of Medicine at Leyden. Sylvius had the advantage over Helmont in that he was acquainted with all the recent advances in anatomy and physiology, and with that admirable equipment he proceeded to carry on the interpretation of the fermentative or chemical processes of the body. He dropped entirely Helmont's mystical tendencies, and stepped forward as the expositor of a purely chemical explanation of natural functions. This was his great merit. He especially carried forward the theory of digestion as a matter of chemistry. He made no great original discoveries, but he was a persistent and inspiring teacher, and he influenced pupils who were more original investigators than he was himself, and we quote from Sir Michael Foster his translation of the admirable portrait of Sylvius drawn by one of his pupils, the great Niels Stensen. We have in the last sentence perhaps the greatest tribute that can be paid to any teacher:

> No one as yet, so far as I know, has so joined Chemistry to Anatomy as to have clearly and distinctly explained, not by deductions from the doctrines of the schools but by following up the indications of Nature, in what respects muscle tendon and bone agree and in what they differ.

> My most eminent teacher Sylvius has laboured in this way with happy results, in respect to the humours of our body; and, if I remember rightly, I have often listened to him while he led by the same spirit of inquiry discoursed also concerning the nature of tendons and bones. But that eminent man although he has done much in this branch of knowledge is, lest he might seem to sacrifice the public weal to his own glory, in the habit of daily assuring his pupils that he has not been able to accomplish everything. Hence he expounds, in the shape of views and speculations, matters concerning which he has not yet arrived at a clear and definite result, and thus he stimulates others to inquiry, supplying them at the same time with problems to begin with.

The other school of thought is known as the Iatro-mathematical School. It had its chief inspiration in the work of Giovanni Alphonso Borelli (1608–79). He was born at Naples, and became Professor of Mathematics, first at Messina, then at Pisa, and then at Messina again. At Pisa he worked side by side, usually in friendship, with Marcello Malpighi, the Professor of the Institutes of Medicine, that profound and immortal investigator with the microscope. It was an association probably as fruitful as any in the whole history of science.

Borelli was primarily a mathematician, and began as a follower of the great Galileo, but he eventually became interested in the application of mathematical principles to the mechanics of animal motion, and ultimately to the explanation of problems of physiology. In this direction he carried out research after research with that seemingly profound ease which is at intervals seen attendant on great genius when it contends with hitherto unsolved problems.

Borelli's name belongs to physiology rather than to medicine, but he must have his place in any account of medical thought because he was followed by a school of medical disciples who applied his mathematical methods to the secrets of the human body, first usefully, but in the end almost to the point of sterility. The human body became likened to a machine, and any function of it could be explained by some analogy in mechanics. Here, indeed, was a doctrine to sweep away the last relics of medievalism, and in that it did this, it partook of the nature of a cleansing process. The greatness of Borelli and his vast services to science, however, cannot be demonstrated in a work not primarily concerned with physiology.

CHAPTER XIII

THE MICROSCOPE AND THE DISCOVERY OF GERMS

One sometimes feels that the Natural World to the first members of The Royal Society must have been like some new wonderful box of toys. It is only necessary to turn over the pages of the early volumes of their *Philosophical Transactions* (they began publication in 1665) to perceive the spirit of enthusiasm which was then the common heritage of the scientific world. It is, in fact, a world so new and so enthralling that one wonders how it could bear to grow old and enter the eighteenth century. The machines, the engines, the pulleys, the pumps, the descriptions of strange phenomena: all are eloquent of the great new spirit of curiosity which was abroad. No wonder that later on (1684), acting more subtly than they realized, they elected the avidly inquisitive Mr. Pepys as their President.

But to return to medicine and its adjuncts, let us hear a contemporary eulogy by Glanvill (1668) of what was on the whole the most useful and epoch-making mechanical aid ever presented to the Faculty, the microscope:

> The secréts of Nature are not in the greater Masses, but in those little Threds and Springs which are too subtile for the grossness of our unhelp'd Senses; and by this Instrument our eyes are assisted to look into the minutes and subtilties of things, to discern the otherwise invisible Schematisms and Structures of Bodies, and have an advantage for the finding out of Original Motions; To perceive the exactness and curiosity of Nature in all its Composures; And from thence take sensible Evidence of the Art and Wisdom that is in its Contrivance; To disclose the variety of living Creatures that are shut up from our bare Senses, and open a kind of other World unto us, which its littleness kept unknown. This Instrument hath been exceedingly improved of late, even to the magnifying of Objects a thousand times, and many useful Theories have been found and explicated by the notices it hath afforded; as appears by the Microscopical Writings of those ingenious Mechanicks, Members of The Royal Society, Dr. Power and Mr. Hooke.

It is essential that in any account of the ideas and accidents which have governed medicine a pause should here be made to

record the invention of the microscope, because there was here presented to the scientific world a new instrument of precise observation which gradually opened up new fields of medical research which we now know as bacteriology, histology, and protozoölogy. It has now become impossible to conceive the world of scientific research without the microscope, yet to the seventeenth century the microscope must have seemed a miracle leading to countless further miracles.

The beginning of the microscope was the optical lens or magnifying glass, and the use of these goes back at least to the thirteenth century. Roger Bacon and his contemporary, the great Bishop Grossetestc of Lincoln, had knowledge of the principles of the simple microscope, and Leonardo da Vinci made certain researches on the properties of optical glasses, and gradually these came to be used as an assistance in the drawing of minute objects. In 1571 an Englishman, Leonard Digges, published a book called *Pantometria,* in which he speaks, as Aubrey, perhaps with a feeling of sympathy puts it, "of cutting glasses in such a particular manner that he could discerne pieces of money a mile off."

It is impossible to speak with any certainty about the first invention of the microscope, and these speculations in any case are not of the first importance, but the credit of it is usually given to Zacharias Jansen, the son of a spectacle-maker of Middleburgh, in Holland. He was born about 1580, and is said one day to have found out by accident the working principle of the telescope. Later on, he and his father Hans, the spectacle-maker, invented and made microscopes. An account of the new instrument reached Galileo, who was then professor at Padua, and he, although he had not seen one, but from his knowledge of the laws of refraction, constructed a microscope for himself. This was about the year 1609. Before the middle of the seventeenth century the new invention had become well established.

It would be easy at this point to stray from the story of medicine, and to allow oneself to be led aside to view the extraordinary achievements in the study of the structure of the human body, of comparative physiology, and of plant life, with which the world was now suddenly amazed. Those things which were hid were now indeed uncovered, and the pictorial rendering of what men saw through the microscope quickly attained a high excellence. But we must as far as possible stick closely to the medical aspect of the subject, and although the story of medicine

in the seventeenth century is largely the story of physiology, we can do no more here than indicate that a new physiological world was now brought before men's eyes, but ourselves remember all the time that what most interests us at the moment is what the discovery of the microscope meant for the doctrines and investigation of contagion.

We have seen that Fracastoro (1484–1553) in his book, *De Contagione* (1546), had enunciated the first really modern theory of contagion.

Between the time of Fracastoro and the middle of our seventeenth century the medical world was from time to time attracted by and curious about the diverse and yet loosely allied phenomena of very small living creatures: vermicles, living atoms, bodikins, and animalcules, and the processes of corruption, putrefaction and fermentation. The magnifying glass had begun to bring to men's eyes some premonition of those mysteries which the microscope was to write large on their consciousness. Such easily discovered subjects as the mites in cheese, the maggots in decaying meat, and even the homely object-lesson of the flea, began to engage the scientific mind, and there is little doubt that by 1650 there was abroad something of that curious spontaneity of kindred ideas in different places of which the history of science from time to time affords instances. But nobody had as yet seen through the microscope those little creatures in the blood on which a new science was one day to be based. One may merely say that the scientific world was prepared to see them.

At this point we are tempted to follow for a few moments a rather dangerous episode (for the experts differ) in the history of microscopy before we proceed to the five great pioneers of the science, especially as its effects can be illustrated by an English writer whose connection with the subject has not, as far as we are aware, been noticed in any detail before.

In 1656 there was plague at Naples and Genoa. It spread to Rome, and it there became one of the score of objects of scientific inquiry on the part of an excessively learned Jesuit priest, Athanasius Kircher (1602–80). He was a man who took all learning for his province, one of those profound dilettanti who filled with their works the shelves of seventeenth century libraries. But Kircher was accustomed to use the microscope, and when he examined with its aid the blood of those who had the plague he was astonished to see "an innumerable Swarm of Worms." Modern microscopists have decided that Kircher

did not see what are now known as bacteria, but either blood corpuscles or perhaps some larger species of micro-organism. But he wrote a book [Plate 51], and published it a couple of years later, *Scrutinium Physico-Medicum Pestis* (1658), and in many passages arrives at a very creditable theory of bacteria. The following two passages, for the translation of which we are indebted to the writer's friend, Mr. Arnold M. Muirhead, express vividly Kircher's surprise at what he saw:

P. 141 : Little worms that cause the plague are very small and imperceptible.

I have shown above that the plague commonly has animate life. For once a sick man has become infected with the ravages of the plague, he is soon subject to a remarkable corruption, which (as I have shown in the same passage) is the most suitable of all for the generation of worms. But these worms which cause the plague are so small, thin, and elusive, that they cheat every attempt at identification by the naked eye, and, if they were not actually seen with the aid of a very powerful microscope, one would say also that they were mere particles. Moreover, they continually multiply in such numbers that one cannot count them: and inasmuch as they have been conceived and generated out of corruption, so they are readily expelled along with sweat through all the passages and pores of the body. Being also set in motion by the slightest disturbance of air, they are disturbed just as particles of dust by a sunray in a dark place: then flowing out of the body, they next cling most tenaciously to whatever they meet with, working their way deeper into any interstices they find.

The corrupt blood of those suffering from fevers has shown me that the process is actually as I have described it. For in one or two hours after blood-letting, I have found the blood so full of worms as almost to render even me astonished, and as a result I am to this extent persuaded that in man, both the living and the dead body breeds innumerable albeit imperceptible worms. And here the saying of Job is much to the point: "I have said to Corruption, 'Thou art my Father': to the Worm, 'Thou art my Mother and my Sister'."

Therefore one infected with the corruption of the plague not only expels a veritable germination of worms through the aforesaid passages of the body, but his dead body also expels these little worms into the air because heat no longer exists in the corruption, and they are then driven into any neighbouring bodies. Since these worms are so very tenacious and elusive, they soon work their way into the inmost fabric of linen and garments, and are there nourished in the same kind of vaporous moisture from which they have come. And this is the primary and chief breeding-ground of all infection, as I shall show.

P. 42: All corruption generates worms spontaneously and of its own substance.

It is so definitely established that air, water, and earth, abound in innumerable worms that it can even be demonstrated to the eye. It was also previously known that worms abound in diseased bodies, but it was not known, until after the wonderful invention of the microscope, that all corruption swarms with innumerable worms that are imperceptible to the naked eye. Even I would never have believed this had I not proved it by frequent experiments over a number of years.

The story of Kircher and his "vermicles" can now be further followed in an episode in the life of a harassed contemporary of his over in England. The two men were bound by nothing in common but the somewhat tenuous link of the worm. The following account of him is offered not for its scientific interest, but it is in some ways not unamusing, and perhaps the hero of it has never hitherto received credit for being one of the first, if not the first, of English writers on the Germ Theory.

Marchmont Needham was one of the earliest of English journalists. He was also at times a free-lance physician, and his one medical book [Plate 51], *Medela Medicinae* (1665), is the reason of his appearance here. But he would be a very picturesque subject for a modern biographer, as he possessed to a remarkable degree that mental adaptability which has, in the progress of journalism, been so useful an ally to the pen, and he was a pioneer in an age when it could be exercised to the last full-stop. Unfortunately the rewards in Needham's day were quite inadequate, for slit ears were then much commoner than glittering prizes. Anthony à Wood, his contemporary, wrote an account of his life with all that art which hardly conceals art, which Anthony had ever at his command when the subject did not meet with his approval.

Needham was born at Burford, in Oxfordshire, in 1620, and like many great men of that period he proceeded to All Souls' College. He was usher at Merchant Taylors' School, and later an Under Clerk at Gray's Inn. He studied medicine too, and by 1645 was practising it.

But previously to that he had started on a journalistic career, and in 1643 a paper called *Mercurius Britannicus* began to appear, in which Marchmont "made weekly sport by railing at all that was noble . . . wherein his endeavours were to sacrifice the fame of some lord, or person of quality, nay, of the

King himself." From which it will be seen that in 1643 he was not on the side of the King. He was arrested twice, in 1645 and 1646.

Then follows a pretty scene when in 1647 he sought the King's presence at Hampton Court, and "then and there knelt before him, and desired forgiveness for what he had written against him and his cause; which being readily granted, he kissed his Majesty's hand, and soon after wrote *Mercurius Pragmaticus*. This, too, was a weekly paper, "which being very witty, satyrical against the Presbyterians, and full of loyalty, made him known to, and admired by the bravadoes and wits of those times." At last he was "narrowly sought after" by the Parliamentarians, and though for a time he "skulk'd at Minster Lovel, near Burford," he was caught and imprisoned in Newgate.

In three months he was out and at it again, and no one knew better than Marchmont that it was quite time to change sides once more, and over he went to the Commonwealth. His vehicle this time was *Mercurius Politicus*, which began in 1650, and went on for ten years. About this time he seems to have made that invaluable psychological discovery that "numbers of inconsiderable persons . . . have a strange presumption that all must needs be true that is in print." Cromwell made him also editor of the *Public Intelligencer*.

Things began to be a little uncomfortable in the year 1660, and he fled to Holland. But not to despair: for shortly afterwards, "for money given to an hungry courtier," he obtained pardon under the Great Seal, and returned to England. He then practised medicine till his death, with only an occasional pamphleteering foray. He died in 1678. "He was," says Wood, "a person endowed with quick natural parts, was a good humanitian, poet, and boon droll."

In 1664 he was writing what was to be his one medical work, apart from two prefaces to other men's books. *Medela Medicinae* is an interesting book, full of fine strong epithets, nor is he unaware of the value of alliteration. It is an attack on the old Scholastic methods, a plea for a return to observation and experience from the blind following of ancient writers. "I would not detract from them . . . but 'tis necessary to be a little brisk in expression, because the world is apt to dote on old authors." And brisk he is, though with an amount of learning, quotation, and pertinent observation surprising in so busy and harassed a publicist. He possesses real insight, and begins scientifically enough by drawing from Graunt's

recently published *Bills of Mortality*. He has a high admiration for Bacon, is very fond of Dr. Willis, and quotes much from Boyle. Again and again he shows himself a modern, and pleads for a chemical rather than a scholastic solution. He is a great opponent of phlebotomy, and desires a new, more experimental, materia medica.

But the most exciting and creditable thing about his book is Chapter V. Kircher's *Scrutinium Pestis* had fallen into Needham's hands (he refers to the author as "the famous Jesuite, now living at *Rome*"), and he gives an account of Kircher's experiments with the microscope, with much real apprehension of what Kircher's discovery of "vermicles" might mean. Needham's definition of a microscope is worth quoting: "An Instrument so made, and fitted with glasses at each end, as that the smallest thing will be represented by it in so considerable a bigness, that the frame and composure of its Parts may be discerned."

Much of Needham's chapter is a skilful patchwork of translated or paraphrased passages from Kircher, and as the object of these few pages is to illustrate Kircher rather than Needham, we have chosen in the following extracts only those which do represent in Caroline English what Kircher wrote in contemporary Latin. Needham gives also a translation of Kircher's account of six experiments on the breeding of worms in putrefying matter, but for these we have not space here.

It should be remembered that we have in the following passages a very early contribution in the English language to the literature of the Germ Theory. It may well be objected that by lifting passages from their context one can prove anything. But here we are not particularly trying to prove a thesis, and Needham himself was not setting out to prove, in the light of the scientific knowledge of to-day, what Kircher had or had not seen, on that particular afternoon in Rome, through his microscope. We merely take the opportunity of observing the impression made by Kircher's work on a competent mind long before the official evolution of the Germ Theory. And Needham himself for his insight in an age of better equipped scientific minds than his was, may as well at last have his due.

Here are his versions from Kircher:

> The Design of this Book is, to treat of the *Pestilence*, its Original, Causes, Signes, and Cure; The occasion of his writing was the strange Nature of the Pestilence which raged at *Naples* and *Genoa*,

PLATE LI

Title-Page of Kircher's "Scrutinium Pestis", Rome, 1658

In this book Athanasius Kircher, a learned Jesuit priest, announced that he had seen living worms in the blood of plague patients through his microscope, and evolved a theory of "living contagion" in which he anticipated the modern science of bacteriology.

Title-Page of Marchmont Needham's "Medela Medicinae", London, 1665

Marchmont Needham, a figure in the history of English journalism, came across Kircher's *Scrutinium Pestis* two or three years after its publication, and with considerable acumen wrote an account of Kircher's theory of living contagion, which he published as the fifth chapter of this book. He translated or paraphrased passages from Kircher, and to Needham credit should be given for apprehending with his quick wit what more learned men in England were slower in taking up. A good example of the crowded title-pages of the seventeenth century. They must at all costs catch the reader's attention. Needham does not describe himself as a Doctor of Medicine, which he was not, but vaguely as "Med. Londinens", a Physician of London.

MEDELA MEDICINÆ.

A PLEA

For the Free Profession, and a Renovation of the Art of

PHYSICK,

Out of the Noblest and most Authentick Writers.

Shewing
- The Publick Advantage of its Liberty.
- The Disadvantage that comes to the Publick by any sort of Physicians, imposing upon the Studies and Practise of others.
- The Alteration of Diseases from their old State and Condition.
- The Causes of that Alteration.
- The Insufficiency and Uselesness of meer *Scholastick Methods* and *Medicines*, with a necessity of new.

Tending to the Rescue of Mankind from the Tyranny of Diseases; and of Physicians themselves, from the *Pedantism* of old *Authors* and present *Dictators*.

The Author, M. N. *Med. Londinens.*

Medice, Cura Teipsum.

LONDON, Printed for *Richard Lownds* at the *White Lion* in S. *Pauls* Church-yard, neer the Little North-door. 1665.

ATHANASII KIRCHERI

N1705. E SOC. IESV

SCRVTINIVM PHYSICO-MEDICVM

Contagiosæ Luis, quæ PESTIS dicitur.

QVO

Origo, causæ, signa, prognostica Pestis, nec non insolentes malignantis Naturæ effectus, qui statis temporibus, cælestium influxuum virtute & efficacia, tum in Elementis, tum in epidemiis hominum animantiumque morbis, elucescunt; vna cum appropriatis remediorum Antidotis noua doctrina in lucem eruuntur.

AD

ALEXANDRVM VII.

PONT. OPT. MAX.

ROMÆ, Typis Mascardi. MDCLVIII.

SVPERIORVM PERMISSV.

Plate LII

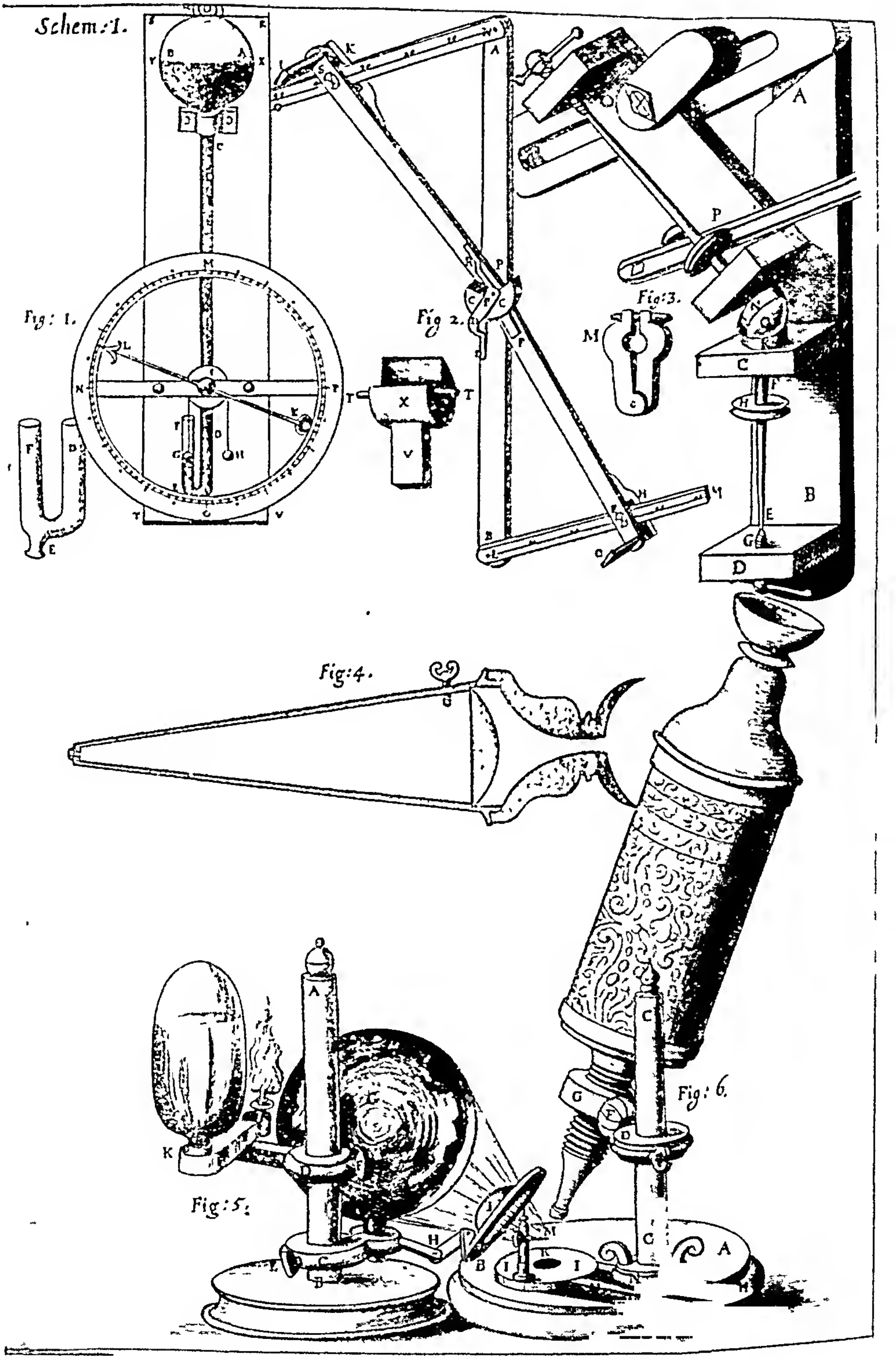


PLATE LII

HOOKE'S MICROSCOPE

This plate is reproduced from Hooke's *Micrographia*, London, 1665, and it was with such an instrument as this that Hooke made his discovery of the cells in cork. The diagrams above the microscope are of an apparatus which Hooke invented to measure the refraction of various liquids. On the left may be seen a condenser for concentrating light, either from the sun or from a wick lamp.

"The *Microscope*", says Hooke, "which for the most part I made use of, was shap'd much like the sixth Figure of the first *Scheme*, the Tube being for the most part not above six or seven inches long, though, by reason it had four Drawers, it could very much be lengthened, as occasion required; this was contriv'd with three Glasses: a small Object Glass . . . a thinner Eye Glass . . . and a very deep one . . .; this I made use of only when I had occasion to see much of an Object at once; the middle glass conveying a very great company of radiating pencils, which would go another way, and throwing them upon the deep Eye Glass. But when ever I had occasion to examine the small parts of a Body more accurately, I took out the middle Glass, and only made use of one Eye Glass with the Object Glass, for always the fewer the Refractions are, the more bright and clear the Object appears. And therefore, 'tis not to be doubted, but could we make a *Microscope* to have only one refraction, it would, *ceteris paribus*, far excel any other that had a greater number".

Anno 1656, and from thence flew to *Rome*, the Symptoms whereof were such as agreed not with the old Descriptions, and baffled all the old Antidotes and Cordials, and puzzled the Phys cians in all their Consultations about the Causes and Cure of it: Which *Kircherus* considering, and pondering various Causes, at length pitched upon those *Effluviums*, *Atoms*, *Corpuscles*, or *Ferments*, which . . . do continually flow forth of all gross Bodies through the Air, whereby even the said gross Bodies do touch and take with one another, according as they are capable to receive Impressions from each other, through the working and counter-working of these Intermedial flitting Atoms or Bodikins, which when they issue from Contagious Bodies, impart somewhat of their own Natural Venom, and improve it, wheresoever they fix; and He thereupon concluded, that some such little contagious bodies as these, carried through the Air, and insinuating themselves into the Bodies of Men, did, by their pernicious Ferment, induce a putredinous pestilent disposition in the Humors, and consequently, the Pestilence it self, where Nature had not strength enough to oppose and hinder the operation of its Fermental Force and Power.

In the above passage we have already arrived at a very creditable theory of bacterial infection. In the following sentences we are taken a step farther and observe in Kircher a definite prescience of bacteria:

But that which most remarkably touches the Point in hand, is, that he introduceth a new *Paradox*, (as himself calls it) into the world, *viz.* That the Contagion of the Pestilence was at that time conveyed abroad, not only by the volatility of such Effluviums, Atoms, and Corpuscles, as are *Inanimate*, but by such also as were *Animated*, living Creatures, and were a sort of *Invisible Worms* or Vermicles. This might seem strange at the first Report, and not to be believed, unless that which is not to be perceived commonly by Sight, may by help of Art be presented to the Eye, and then there is no disputing against Sense.

This that Author undertakes to do, (of which more by and by) and saith, That these Animated Effluviums are constituted of indiscernable Animated Corpuscles, it doth appear by the multitude of Worms which are wont to issue out of one and the same Body; of which some are so big that they are presently seen, the rest remain in an undiscernable state of Magnitude, yet multiplyed in so great a number, as the numberless Corpuscles or Particles are, of which the Effluvium doth consist; and being exceeding subtile, thin, and light, they plie to and fro, no otherwise than Atoms do, with the least puff or motion of the Air:

And he saith, These Worms are so fine, that they insinuate themselves, not only into Clothes, Ropes, and Linen, but into other Bodies less Porous, as Cork, Wood, Bones; yea, into those which are least Porous and most compact, as metals, money, &c. Of this he in another place tells us, they had daily Experience in the Plague-time, at *Naples* and *Rome*, where no money was received in Payment, but what was first well soaked and washed in

Vinegar, if it came from any Infected Place; and he believed, nothing could resist the penetration but Diamonds only, because of their polished Superficies, and unconquerable hardness.

By such *Animated Effluviums* as these, *Cardan* saith, the great Plague that fell out in his time at Milan was raised, which unpeopled that great City, not only the Air being filled with them, but the very dust of the Earth animated into such kind of Vermicles.

Here is a passage which is of interest as it displays the novelty of the microscope to the seventeenth century reader:

But if you would know, how these Vermicles come to be made visible, which are of so minute a Magnitude, and so subtil a Substance; the same Author tells us, the visibility is attained by the Instrument called a Microscope. These things (saith he) may perhaps seem Paradoxes to the Reader, but when he shall, as I have done, by Experiments made the space of many years, by the help of most exquisite Microscopes, throughly see with his own Eyes, then I suppose, he will not only believe these things to be so, but instructed by Experience, be ready to attest the Truth of what I have said.

In the following extract Kircher, through his interpreter Needham, is not so satisfactory from the point of view of modern science, but it is instructive as displaying the mind of the early microscopist trying to grapple with the difficulties of the situation:

The learned Author gives so much Light to this as hath convinced me, by manifold *Experiments*, which because they are the best kind of Arguments; and the clearing of this being of very great importance to the practice of Physick, I will set down all, but make them as short as I can. Before he comes to *Experiments*, he lays down this for a Position; *Omne Putridum, ex se & sua Natura gênerare Vermes:* i.e. *That every thing which is Putrid, doth of it self, and by its own Nature, generate Worms:* whereupon he thus reasoneth. Whereas all generation consists in what is hot and moist, according to the Philosopher's determination, a twofold Corruption may here be considered; the one Natural, the other specially adventitious or beside Nature, which properly is wont to be called Putrefaction.

I say therefore, that there is no living thing which is not lyable to Putrefaction, even as the Philosopher [Aristotle] himself affirms. For the understanding whereof, it is to be noted, that no living thing can be generated out of what is formally Putrid. But whenas that which is putrefied, being a mixt Body, is, by separation of impure parts from the pure, resolved into its own Elements, and whereas the pure Parts natural to the mixt Body being mingled with the putrid, are agitated by heat; and forasmuch as Nature always intends the best hence it comes to pass, that the external

heat works the prepared matter, not into any thing which is of an Excrementitious Nature, but thrusts forth the purer Parts of the Mixt Body into somewhat that is animated; and this is the only Cause of the Original of Animals out of Putrefaction.

Moreover, whereas Philosophers are wont commonly to say, that some Animals are generated out of meer Putrefaction alone, that is true, if we conceive the whole putrefaction of a mixt Body to be performed under one Action, but because no mixt Body is so corrupted, but that some of the purer Parts natural to it do remain; therefore when these purer Parts become Tinctured with in an ill fuliginous quality through the putrefying of the Excrementitious Parts, hence it falls out, that the said purer Parts being agitated by external heat, do thrust forth an Off-spring of Animals, of the same Nature with the Excrementitious Parts which gave the Tincture.

Again, there is no kind of Plant which doth not out of slime or mucous Matter, generate a certain Worm peculiar to it self; which secret is in these last Times discovered by the *Microscope*, and will be more experimented. Yea, Vinegar, Milk, the Blood of men in Fevers, are perceived to be full of Worms, although not to be discerned by an eye that is not armed with that Instrument.

Our last quotation is a short one of which we have already given a modern translation, but we repeat it so that the two may be compared, and that it may be seen how closely on the whole Needham reproduced Kircher:

All Bodies are subject to Putrefaction, and out of Putrefaction spring Animals. And that Worms of bigness visible arise out of putrid Bodies, is a matter known to All; but that all putrid Bodies should abound with an innumerable Swarm of Worms not to be perceived by the eye of it self, is a matter that was never known till the admired Invention of the *Microscope*: which I my self could never have believed, unless I had found it true by many years experience.

To sum up, Kircher, whatever he saw through his microscope, arrived by remarkable flashes of insight or prescience, at a basis for the modern germ theory. Here is one of the occasions where the idea is greater than the fact of the moment, and where, for once, the end justifies the means. To Needham also must be given the credit of seizing, in the true journalistic spirit, on the importance of Kircher's theory, and of presenting it, all hot from the press, to his readers, probably before his more academic brethren in England had awakened to the situation.

There now follow five great names of men who, gifted with he delight of taking infinite pains, established the new science

of microscopy on a firm basis, backed up by a series of books illustrated with engraved plates of wonderful beauty and accuracy. We have now left the vague regions of Kircher, and enter the terrain of exact science.

The researches of these men belong chiefly to the departments either of vegetable or animal or human histology and physiology, but it is essential to make grateful mention of these pioneers, because without them the science of bacteriology would be unknown, and medicine might still be groping, sightless, in the infinite dark.

To begin, then, in our own country, there is first Robert Hooke (1635–1703). He was Curator of Experiments to the Royal Society, and one of the most remarkable and versatile men of his age. For some reason or other, possibly because he was overshadowed by his great junior Newton, justice has hardly been done to his memory till lately, when Dr. R. T. Gunther, of Magdalen College, edited and published *The Life and Work of Robert Hooke* (2 vols., Oxford, 1929). "Had he," writes Dr. Gunther, "been a countryman of Galileo or Goethe, the whole world would now be ringing with his fame." If the reader will look into these two volumes he will be astounded that any man could possess such powers of invention, or be at home in every branch of scientific research. He was an architect as well, and was Surveyor to the City of London after the Great Fire. "Before I leave this towne," writes his friend Aubrey to Anthony à Wood in 1689, "I will gett of him a catalogue of what he hath wrote; and as much of his inventions as I can. But they are many hundreds; he believes not fewer than a thousand."

It is always well, if we can, to carry away some scent or colour of a man's period, so let us stay for a moment to read also what Aubrey, his contemporary and friend, says about Hooke:

> He is but of midling stature, something crooked, pale faced, and his face but little belowe, but his head is lardge; his eie full and popping, and not quick; a grey eie. He haz a delicate head of haire, browne, and of an excellent moist curle. He is and ever was very temperate, and moderate in dyet, etc. . . . As he is of prodigious inventive head, so is a person of great vertue and goodness. . . . He is certainly the greatest mechanick this day in the world.

A vivid portrait, and more arresting than can be written by any modern pen. We are giving these details of Hooke because it is to him that the scientific world owes the foundation of the

Cell Theory, which, in Dr. Gunther's fine phrase, "became the greatest biological generalization of all ages."

In the year 1665 Hooke published the beautiful small folio volume called *Micrographia: or Some Physiological Descriptions of Minute Bodies Made by Magnifying Glasses. With Observations and Inquiries Thereupon.* It is from this book that we may date the beginnings of the Cell Theory, on which the whole of modern biology rests. Hooke discovered what he himself named "cells" in the structure of cork, and it was for the science of a later day to expand this working discovery to the whole realm of histology. Schleiden (1804–81) and Schwann (1810–82) early in the nineteenth century developed the Cell Theory as one of the greatest instruments of modern research. But here is Hooke's description of his great experiment:

> I took a good clear piece of Cork, and with a Pen-knife sharpen'd as keen as a Razor, I cut a piece of it off, and thereby left the surface of it exceeding smooth, then examining it very diligently with a *Microscope*, me thought I could perceive it to appear a little porous; but I could not so plainly distinguish them, as to be sure that they were Pores, much less what Figure they were of: But judging from the lightness and yielding quality of the Cork, that certainly the texture could not be so curious, but that possibly, if I could use some further diligence, I might find it to be discernable with a *Microscope*, I with the same sharp Pen-knife, cut off from the former smooth surface an exceeding thin piece of it, and placing it on a black object Plate, because it was it self a white body, and casting the light on it with a deep *plano-convex Glass*, I could exceeding plainly perceive it to be all perforated and porous, much like a Honey-comb, but that the pores of it were not regular; yet it was not unlike a Honey-comb in these particulars.
>
> First, in that it had a very little solid substance, in comparison of the empty cavity that was contain'd between, as does more manifestly appear by the Figure A and B of the XI. *Scheme*, for the *Interstitia*, or walls (as I may so call them) or partitions of those pores were neer as thin in proportion to their pores, as those thin films of Wax in a Honey-comb (which enclose and constitute the *sexangular cells*) are to theirt [Plate 53].
>
> Next, in that these pores, or cells, were not very deep, but consisted of a great many little Boxes, separated out of one continued long pore, by certain *Diaphragms*, as is visible in the Figure B, which represents a sight of those pores split the long-ways.
>
> I no sooner discern'd these (which were indeed the first *microscopical* pores I ever saw, and perhaps, that were ever seen, for I had not met with any Writer or Person that had made any mention of them before this) but me thought I had with the discovery of them, presently hinted to me the true and intelligible reason of all the Phaenomena of Cork.

One of the great charms of the scientific books of the seventeenth century is that their authors are still human, and have not yet crystallized into the Pure Scientist. In this work of Hooke's, which is certainly one of the most important contributions to human knowledge which that age produced, he cannot on one occasion resist the temptation of being still the whimsical Englishman, the contemporary of punning, leisurely Thomas Fuller. Here is the preamble to his microscopic description of the Louse. We quote it not merely because it is an amusing thing, but because it affords us some insight into the mind of the seventeenth century:

> This is a Creature so officious, that 'twill be known to every one at one time or other, so busie, and so impudent, that it will be intruding it self in every ones company, and so proud and aspiring withall, that it fears not to trample on the best, and affects nothing so much as a Crown; feeds and lives very high, and that makes it so saucy, as to pull any one by the ears that comes in its way, and will never be quiet till it has drawn blood: it is troubled at nothing so much as at a man that scratches his head, as knowing that man is plotting and contriving some mischief against it, and that makes it often-time skulk into some meaner and lower place, and run behind a man's back, though it go very much against the hair; which ill conditions of it having made it better known than trusted, would exempt me from making any further description of it, did not my faithful *Mercury*, my *Microscope*, bring me other information of it.

Mention must be made of Nehemiah Grew (1641–1712), an English physician, because he furthered the technique of histology and physiology and of micrographic illustration by the application of the new science to the structure of vegetables and plants. He published a very beautifully illustrated book, *The Anatomy of Plants*, 1682, in which he first adumbrates the idea of sex in plants. The discovery, however, was not entirely his own, but that of his friend Sir Thomas Millington, who was later on President of the College of Physicians. Grew follows Hooke in his use of the term "cells."

The most important of the early microscopists from the physiological standpoint was Marcello Malpighi (1628–94), but for that reason he must be given less space here than workers who contributed to the inception of the science of bacteriology. He was born at Crevalcuore, near Bologna, and held successively professorships at Bologna, Pisa, Bologna again, Messina, and then finally for a quarter of a century at Bologna. To the period at Pisa was due the enrichment of the lives of two of the greatest

of seventeenth century men of science by the friendship of Malpighi and Borelli, who suggested problems to each other, and even attended each other's lectures.

Malpighi's whole scientific life was given up to the examination of minute structure, and he was one of the founders of the modern sciences of biology, histology, and vegetable morphology. He is also the founder of embryology, for in his book on the formation of the chick (*De Formatione Pulli in Ovo*, 1673) he gives beautiful and accurate drawings of the stages of the chick in the egg.

Malpighi discovered the capillaries (1661), the blood-vessels which carry the blood from the arteries to the veins. He thus completed the work of Harvey, who had left this one link in the circulatory system unexplained. He also made most important investigations into the structure of the lungs, the liver, and the kidneys, as well as the physiology of the glands. His name has been given to the lower layer of the skin, the rete mucosum or Malpighian Layer, which he discovered. That our Royal Society was, very early in its career, infinitely more than an insular or local association of learned men, is witnessed by the fact that in 1667 its secretary, Oldenburg, sent to Malpighi, a letter inviting him to correspond with the Society. This correspondence went on for many years, and it was the Royal Society which bore the expense of publication of the great Italian's works. We can observe here how honourably and fully the words of Bishop Sprat were bearing fruit in action.

It might be expected that the Hollander, with his love of detail and order and neatness, would prove a good experimenter with the microscope. Not only did Holland produce the microscope, but it also produced Anthony van Leeuwenhoek (1632–1723), whose name among the microscopists is the most important of all for the theme of this book. Leeuwenhoek presents the very interesting case of a man born of well-to-do parents, not given a good education, as he was designed for the world of trade, and then, when a young man, discovering exactly what he wanted to do in quite another sphere, and, regardless of worldly advancement, doing it for the rest of his long life. He was indeed one of the fortunate ones.

For a while Leeuwenhoek was either a draper or in the counting-house of a draper, but at about the age of twenty-eight he obtained the appointment of Chamberlain to the Sheriffs of Delft, his native town. Whether the office was a sinecure, or whether Leeuwenhoek had duties to perform, does not now

particularly matter. The important fact is that he lived to the age of ninety-one, and spent the greater part of his working-life among his microscopes, and subjected to them every conceivable small object in the world of nature that came to his hand. Nothing escaped him. He made his own microscopes, and ground his own glasses and mounted them. We might note here that both Leeuwenhoek and Malpighi preferred on the whole to use a single-lens microscope, and that with the simplest apparatus the greatest discoveries were made. There seems little doubt that in the grinding of lenses Leeuwenhoek was an artist of the first rank.

He appears to have had no scientific method, except that he was by nature possessed of the best of scientific methods; he used his eyes and exercised his brain with the method and insight of a genius. He went on through the long years at Delft examining everything in a leisurely way, and sending letters, describing what he saw, to the Royal Society. Here again we see the Royal Society acting as the great clearing-house of knowledge. To them at the age of forty he was introduced in a letter by Regnier de Graaf, the physiologist, who sent them an account of some of Leeuwenhoek's observations. Thereafter for the rest of his life Leeuwenhoek sent them constant communications announcing his discoveries. He corresponded also, but on a much smaller scale, with the Paris Academy of Sciences. He became known for what he was, a very distinguished man. The Directors of the East India Company sent him specimens. Peter the Great called on him. There is an incidental reference to him in the *Philosophical Transactions* for 1683, which shows in a charming way how everyone knew of his interests and activities. Dr. Frederick Slare, writing of an epidemic, where animals were infected, remarks: "I wish Mr. Leewenhoeck had been present at some of the *dissections* of these infected *Animals*, I am perswaded He would have discovered some strange *Insect* or other in them."

We now reach the central fact of the theme of this chapter. In the year 1683, or perhaps earlier, Leeuwenhoek first saw bacteria, and in 1683 he published drawings of them in the *Philosophical Transactions*. About the year 1675 he discovered protozoa in water, and the discovery was published in the *Philosophical Transactions* in 1677. Professor Clifford Dobell remarks that this letter may "be regarded as the first page in the history of protozoölogy."

Let us quote, too, another sentence from Professor Clifford

PLATE LIII

The Cells in Cork

In this plate (from *Micrographia*, 1665) Hooke illustrates for the first time cells in a vegetable structure, and by his discovery lays the foundation for the Cell Theory which was to be developed to such great ends by Schwann and Schleiden, and later by Virchow, in the nineteenth century. Hooke cut sections of cork thin enough to permit light to pass through them and observed the two aspects of the cells which he shows (*see* page 157). In the following passage Hooke seems to apprehend that he was only on the threshold of further discoveries concerning the life of the cell:

"Now, though I have with great diligence endeavoured to find whether there be any such thing in those *Microscopical* pores of Wood or Piths, as the *Valves* in the heart, veins, and other passages of Animals, that open and give passage to the contain'd fluid juices one way, and shut themselves, and impede the passage of such liquors back again, yet have I not hitherto been able to say anything positive in it; though me thinks, it seems very probable, that Nature has in these passages, as well as in those of Animal bodies, very many appropriated Instruments and contrivances, whereby to bring her designs and end to pass, which 'tis not improbable, but that some diligent Observer, if help'd with better *Microscopes*, may in time detect".

Fig:1.

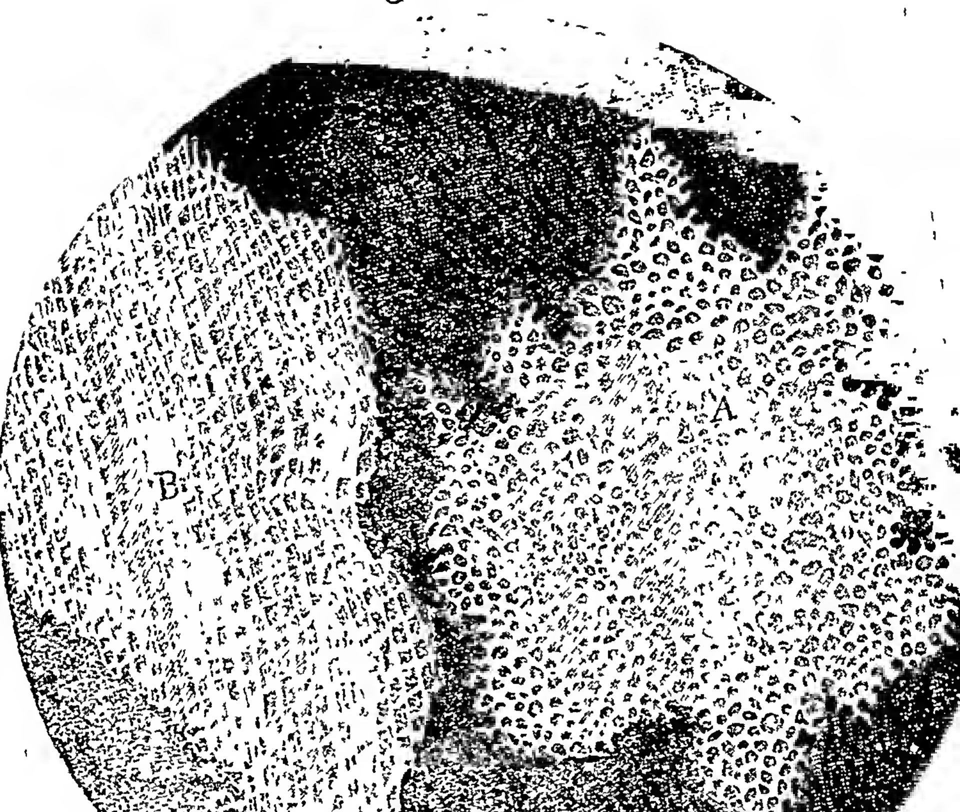


Fig 2.

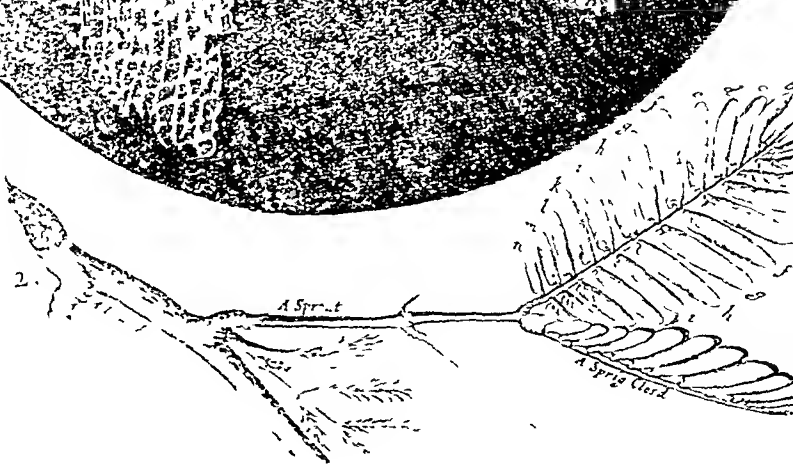


PLATE LIV

HERMANNI BOERHAAVE
SERMO ACADEMICUS
DE COMPARANDO CERTO
IN PHYSICIS.

LUGDUNI BATAVORUM,
Apud PETRUM VANDER AA, Bibliopolam.

MDCCXV.

PLATE LIV

Boerhaave Lecturing

Hermann Boerhaave, Professor of Medicine at Leyden, was the greatest power and influence in medicine in Europe in the early eighteenth century. Here he may be seen delivering the oration at the end of his year as Rector of the University of Leyden. The subject is the Means of Arriving at Truth in the Physical Sciences. In this picture the great dignity of the academical world of Boerhaave's time is well conveyed. *De Comparando Certo in Physicis* was published in 1725.

Dobell which vividly gives to Leeuwenhoek his due place in the world of medical science: "He was the first bacteriologist and the first protozoölogist, and he created bacteriology and protozoölogy out of nothing."

What in other ways Leeuwenhoek did with the microscope it is hardly possible even to summarize here. His labours were so vast, and extended over so many years, that the study of them would be the work of a trained specialist. He made investigations into the composition of articles of diet, and is thus an early food chemist. He was interested in the subject of insensible perspiration. He opposed the doctrine, which was prevalent in those days and till very long after, of the spontaneous generation of small animals.

Leeuwenhoek was the first to describe the spermatozoa which, however, were not actually his discovery. He demonstrated and described the capillary circulation which had been discovered by Malpighi. His observations were made on the tadpole, and his communication on the subject he sent to the Royal Society, though they did not publish it. "Herewith I again send you some of my trifling observations." Here finally Harvey's work on the circulation was made complete. Leeuwenhoek gave the first full account of the red blood-corpuscles (1674), though they were discovered by his countryman Swammerdam in 1658.

Leeuwenhoek was the first man to *see* the complete circulation of the blood which Harvey had described and proved. For some time Leeuwenhoek could not hit on the animal which could for this special purpose be completely observed through the microscope. He tried and failed with the combs of cocks, the ears of white rabbits, the wings of bats, but was finally successful with the tadpole. Here is his description of what no man had seen before:

> Upon examining the tail of this creature, a sight presented itself, more delightful than any that my eyes had ever beheld; for here I discovered more than fifty circulations of the blood, in different places, while the animal lay quiet in the water, and I could bring it before the microscope to my wish. For I saw, not only that the blood in many places was conveyed through exceedingly minute vessels, from the middle of the tail towards the edges, but that each of these vessels had a curve, or turning, and carried the blood back towards the middle of the tail, in order to be again conveyed to the heart. Hereby it plainly appeared to me, that the blood-vessels I now saw in this animal, and which bear the names of arteries and veins, are, in fact, one and the

same, that is to say, that they are properly termed arteries so long as they convey the blood to the farthest extremities of its vessels, and veins when they bring it back towards the heart.—(*Hoole's Translation*, 1798.)

In the following passage we hear Leeuwenhoek making a general defence of his discoveries. It is of value, also, as giving some idea of the wonder and enthusiasm felt by these early microscopists:

> I have often heard, that many persons dispute the truth of what I advance in my writings, saying that my narrations concerning animalcules, or minute living creatures, are merely of my own invention. And, it seems, some persons in France have even ventured to assert, that those are not living creatures, which I describe as discoverable to our sight, and alledge, that after water has been boiled, those particles in it which I pronounce to be animalcules will be still observed to move. The contrary of this, however, I have demonstrated to many eminent men, and I will be so bold to say, that those gentlemen who hold this language, have not attained to a degree of proficiency to observe such objects truly.
>
> For my own part, I will not scruple to assert that I can clearly place before my eye the smallest species of those animalcules concerning which I now write, and can as plainly see them endued with life, as with the naked eye we behold small flies, or gnats sporting in the open air, though these animalcules are more than a million of degrees less than a large grain of sand. For I not only behold their motions in all directions, but I also see them turn about, remain still, and sometimes expire; and the larger kinds of them I as plainly perceive running along, as we do mice with the naked eye. Nay, I see some of them open their mouths, and move the organs or parts within them; and I have discovered hairs at the mouths of some of these species, though they were some thousand degrees less than a grain of sand.—(*Hoole's Translation*, 1798.)

The last of our group is another Hollander, Jan Swammerdam (1637–80). He was born at Amsterdam, the son of a naturalist, and became a physician. He died at the early age of forty-three, and towards the end of his life became the victim of religious melancholy, and in him we could observe, if we had the space, the struggle between religion and science, not in this case in tribunal or consistory, but in a man's own mind.

Swammerdam made important researches on the volume of the heart and on muscular action. He discovered the red blood-corpuscles in 1658, and like Leeuwenhoek opposed the doctrine of spontaneous generation which was to cause so much contention among scientists later on, and even down to the time of

Pasteur. But it was by his great and enthusiastic work on the comparative anatomy and life histories of small insects that he helped to build up the new science of observation of minute structures and tissues.

The lessons taught by the work of these early microscopists did not wholly bear fruit till the nineteenth century, but it must not be forgotten that while Hooke is examining his piece of cork, or Grew the leaf of a tree, or Malpighi the structure of the lung, or Swammerdam a bee's wing, or Leeuwenhoek the tartarization from teeth, the method of investigation is the same, and that these men laid the foundation of what would one day be the profoundly important sciences of biology, physiology, histology, and bacteriology.

CHAPTER XIV

A BASIS OF MODERN PNEUMO-THERAPY: FIRST RESEARCHES IN BREATHING

ANY ACCOUNT of medicine in the seventeenth century must necessarily trespass continually on the borderland of physiology, because during this golden period the history of medicine is largely the history of physiology. However anxious a writer may be to exclude the subject of physiology from his book it becomes impossible during this century to do so entirely. Harvey, by his profound discovery, makes it clear to us (though not perhaps entirely clear to himself or his contemporaries) that no further progress in medicine could be made till the secret of the circulation was solved.

But there was another unanswered riddle that equally obstructed the way to further real progress in the treatment of disease, and this was the problem of why we breathe, and what happens to the air that we do breathe. It began to be answered in the seventeenth century.

The indefatigable Robert Hooke was involved in the solution of the riddle, and the title of his resultant contribution to the *Philosophical Transactions* convinces one immediately of the essential importance of the physiology of Respiration in a book concerned with health and the preservation of it. The title of Hooke's paper was "A Supply of Fresh Air Necessary to Life." It is a title which might head any piece of propaganda by a Public Health Officer to-day. Its implications are obvious. There at once fall, as it were, on our unsuspecting heads, whole libraries of subsequent works on Fresh Air, Foul Air, Germ-laden Air, Contaminated Air, Change of Air, Sea Voyages, the Arrest of Consumption, Ventilation, and the Importance of Deep Breathing. The carrier pigeons were indeed on this occasion released from their cage to soar into the larger air.

There were four stages in the discovery, and these four stages were due to the investigations of four great men, all members of the Oxford group, and all of them Fellows of the Royal

Society. The election of the last was somewhat delayed, though he was probably as great as any of the previous three. Even after his death the fame of John Mayow was in a curious way sunk in the waters of oblivion for a century.

The first step was due to the Honourable Robert Boyle (1627–91), the son of the Earl of Cork, who like other seventh sons had special gifts. Boyle was primarily a chemist, but he was also a great deal more than this, for he was a great and tireless investigator into most of the branches of Natural Science, and anybody who is acquainted with the great range of Boyle's writings may be said to know the whole stirring scientific world of the seventeenth century. The attention of the curious reader may especially be drawn to the two volumes of Boyle's *Usefulness of Experimental Philosophy* (1663–71), which are unfortunately rather rare, although they can be seen in most good scientific libraries, and to the admirable and most instructive bibliography of his works, with a bibliographical and critical introduction, lately published by Dr. John Farquhar Fulton, Professor of Physiology at Yale University (Oxford Bibliographical Society).

Joseph Glanvill, besides being a grave divine and Rector of Bath Abbey Church, wrote a defence of the works of the Royal Society (*Plus Ultra*, already cited), and it is of great value to be able to obtain from this book a contemporary view of Boyle. Glanvill devotes two chapters to him and his achievements. We quote the following passage as indicative of the tribute which an acute and even a partly ecclesiastical mind could pay to this great man:

> But, Sir, I think I am fallen into things of which the *Ingenious Historian* [Bishop Sprat] hath somewhere given better *accounts*, and therefore I *draw* off; though before I quite take leave of this *Head* of my Discourse, I think fit yet further to shew the *injustice* of the Reproach of having *done nothing*, as 'tis applied to the *Royal Society*, by a *single* Instance in one of their *Members*, who alone hath done enough to oblige all Mankind, and to erect an *eternal Monument* to his Memory. So that had this *great Person* lived in those days, when men *Godded* their *Benefactors*, he could not have miss'd one of the first places among their *deified Mortals*. And you will be convinc'd that this is not *vainly* said, when I have told you, I mean the *Illustrious* Mr. *Boyle*, a Person by whose proper Merits that noble Name is as much *adorned*, as by all the *splendid Titles* that it wears.

Now Boyle, in the course of his scientific experiments into the weight and pressure of the air, had discovered by the aid

of the air-pump which he, with the aid of Hooke, had devised, that if a mouse or a sparrow and a lighted candle were put into a glass vessel, and the external air was withdrawn, the candle went out, and the animal died soon after. Nor could another animal live in the same air which had proved insufficient to preserve the life of the former animal. Boyle came to the conclusion that in some way breathing and combustion were an identical process.—(*Relation betwixt Flame and the Air*, 1672, pp. 109 *et seq.*)

Boyle's former laboratory assistant, Robert Hooke (1635–1703), whom we have already met in connection with the microscope, next showed that an animal could be kept alive by artificial respiration, and that by putting the mechanism of the lungs out of action, but continuing the supply of air with a bellows, the animal could be kept alive for some time. He, therefore, inferred that it was the exposure of the blood to the air, and not the movement of the lungs, that was essential to the preservation of life.

A further most important link in the argument was then forged by Richard Lower (1631–91), a physician who when a young man had worked with Wren under Willis at Oxford, and who published in 1669 a book on the Heart and the Motion and Colour of the Blood (*Tractatus de Corde. Item de Motu & Colore Sanguinis*), which, after Harvey's, is probably the most important contribution to the classic literature of the subject. Lower's mind began to work towards some solution of the problem why arterial blood should be red and venous blood dark, and now with Hooke's experiment before him he gradually formed the opinion that the blood changed colour during its course through the lungs because of its exposure to the air, and because the blood took up some of the air. The following enormously suggestive sentence, bringing us right forward to the time of John Howard and Prison Reform, occurs in Lower's account: "Were it not for this we should breathe as well in the most filthy prison as among the most delightful pastures." He remarks also: "Wherever fire can burn with ease we can breathe with ease."

There next comes on to the scene John Mayow (1645–79), a younger man than his three Oxford friends, at once a lawyer and a physician, who by the time he was twenty-five had supplied the clue to the most baffling and elusive problem of respiration, which at the same time solved that intricate problem and presented the world with a gift, the virtual discovery of

oxygen, which it refused for a century till its rediscovery by Lavoisier.

Mayow published his discoveries in a book, *Tractatus Quinque*, 1674. It is among the special rarities of medical literature. He had previously published two of these tracts in 1668, and after the publication of the first volume he appears to have withdrawn himself from the world of research. Perhaps he was discouraged by a lukewarm review of his book by Oldenburg, the Secretary of the Royal Society, in the *Philosophical Transactions*. He seems to have spent the next ten years between Bath and London, practising as a physician. Unknowingly he was one of the great figures of physiology. Had he gone on he might have been among the greatest. But he died at the age of thirty-four, and his life's work had been done by the time he was twenty-five. He is almost the Keats of physiology.

Mayow by much musing on the qualities of nitre and the manner of its formation in decomposing vegetable and animal matter had come to the conclusion that there was some constituent in the air which he called "Spiritus Nitro-Æreus". He then showed by experiment and argument too elaborate to follow here that in the identical process of respiration and combustion it is not the whole air which is taken up, but only the spiritus nitro-æreus which is in the air. By reasoning exquisite, subtle, and final, he proves that it is what we now know as oxygen that is as essential to life as it is to fire, and that it is his spiritus nitro-æreus which by chemical action changes the dark venous blood to the colour of red in arterial blood.

He explains also the use of Expiration. "About expiration it is to be noted that this serves a further purpose, namely, that together with the air driven out of the lungs, the vapour of the blood agitated by the fermentation is blown away also."

About a hundred years later, Dr. Thomas Beddoes, of Bristol (the father of Thomas Lovell Beddoes, the poet), who was interested in the therapeutic use of air, expecially for consumption, came on Mayow's book, and published extracts from it. Lavoisier had named oxygen in 1775. Thus the world at last caught up with John Mayow of All Souls' College.

CHAPTER XV

THOMAS SYDENHAM, THE MASTER OF CLINICAL MEDICINE

But what, one asks, while all these cloistered gentlemen had been making their dissections, peering through their microscopes, forming their fine theories and drawing their conclusions, writing their Latin treatises, and themselves ultimately dying of the stone, what had been happening all this time to the wretched patient languishing in English town or village? He cannot have been having a very good time of it, and perhaps the most cheering thing that can be said is that the average man is normally healthy and does not languish often or for very long at a time. Fortunately, the art of medicine throughout the ages has had to concern itself with the exception rather than with the rule.

The immediate effect upon treatment of all the physiological research which had been going on must have been negligible, and there is a kind of grim irony in the well-known story that Harvey's practice, after his discovery of the Circulation, "fell mightily". The common ills were but little aided by the high discussions at Gresham College or at Oxford. Medicine necessarily lagged far behind research, and the actual practical application of the latter was in many cases delayed till the eighteenth and nineteenth centuries.

In the seventeenth century there was a wild and wide outburst of what may be called secular superstition. This was probably one of the reactions of the Reformation. It was an age of quacks, mountebanks, astrology, alchemy, witchcraft, nostrums, and proprietary medicines. Some of these proprietary medicines are still flourishing and can be purchased to-day under the same names as they bore then.

Nor were the learned and official curators of the public health living exactly in the sunshine of enlightenment. In our chapter on Hippocrates we have spoken of the transition from superstition and conservatism to the blazing daylight of the West. But the pall of the Dark and the Middle Ages was to

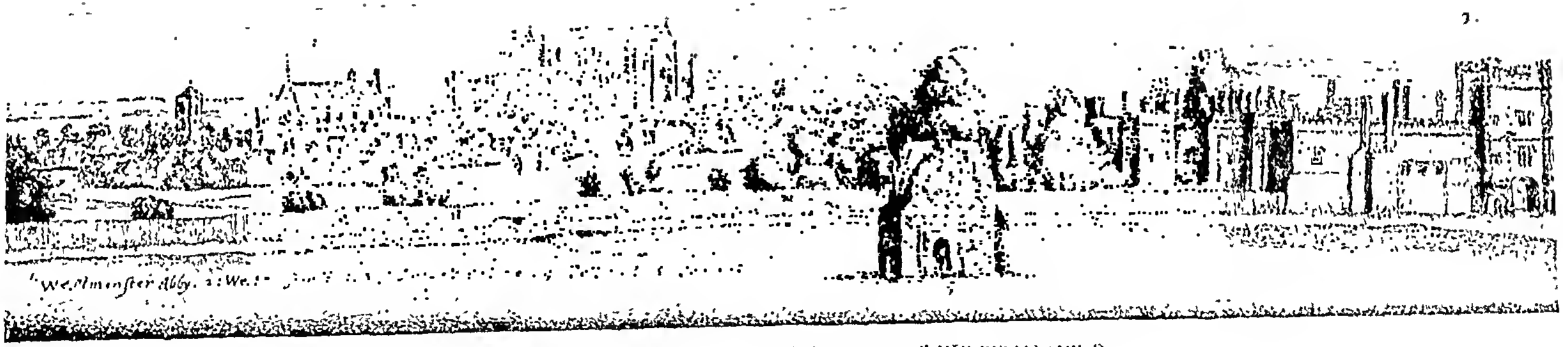
PLATE LV

Pall Mall and Westminster in Sydenham's Days

Thomas Sydenham (1624–89), the most important exponent of clinical medicine from the days of his master, Hippocrates, practised in King Street, Westminster from 1656 to 1659. His house in Pall Mall, where he lived from 1667 to his death in 1689, was about 200 yards east of this view by Wenceslaus Hollar, dated 1660. "Pell Mall" is the country road seen in front of the walls of St. James's Park. The latter, until it was enclosed and drained by Henry VIII in 1531, was a wet marshy field. St. James's Square now includes the site of water conduit in the foreground.

Courtesy of Dr. J. D. Comrie.

PLATE LV



S^t. JAMES'S PALACE and part of the CITY of WESTMINSTER.

Taken from the N^th side of Pall Mall

As they appeared about the Year 1660.

From an Antient Drawing in the possession of John Towneley of *Towneley* Esq. F.R.S. F.S.A.

Thomæ Sydenham, M.D.

OPERA UNIVERSA.

In quibus non ſolummodò Morborum Acutorum Hiſtoriæ & Curationes novâ & exquiſitâ methodo diligentiſſimè traduntur, verùm etiam Morborum ferè omnium Chronicorum Curatio breviſſima, pariter ac fideliſſima in Publici commodum exhibetur.

Editio altera, priori multùm auctior, & emendatior reddita.

Huic etiam de novo acceſſit Index Alphabeticus ſummam omnium rerum, & Curationum ſingularum, in gratiam ſtudioſorum, breviter complectens.

LONDINI,

Typis *R. N.* impenſis *Walteri Kettilby*, ad Inſigne Capitis Epiſcopalis in Cœmeterio D. *Pauli*, 1685.

PLATE LVI

Title-Page of the First Collected Edition of Sydenham's Works, 1685

This edition was published four years before Sydenham's death. It is called Second Edition (*Editio Altera*) on the title-page, but no copy of an earlier edition is known, though one is said to have appeared in 1683. In this volume are collected Sydenham's sturdy and independent writings on Fevers (including agues) and Epidemics, the Small Pox, Gout, Dropsy and Hysteria.

descend, and one has indeed to be a robust enthusiast to defend or explain away the resultant soilure.

In 1618 the Royal College of Physicians published the First Edition of the London Pharmacopœia. The Second Edition appeared in 1650, and the Third in 1677. A beginning had to be made to set the materia medica in order, and any attempt was praiseworthy, but what precisely was the pharmaceutical background while Harvey was making his dissections and delivering his Lumleian Lectures and meditating his book may be gathered from a brief quotation from Dr. Fielding Garrison's *History of Medicine:*

> Among the queer remedies contained in the three London Pharmacopœias of the period were the blood, fat, bile, viscera, bones, bone-marrow, claws, teeth, hoofs, horns, sexual organs, eggs, and excreta of animals of all sorts; bee-glue, cock's-comb, cuttlefish, fur, feathers, hair, isinglass, human perspiration, saliva of a fasting man, human placenta, raw silk, spider-webs, sponge, sea-shell, cast-off snake's skin, scorpions, swallows' nests, wood-lice, and the triangular Wormian bone from the juncture of the sagittal and lambdoid sutures of the skull of an executed criminal.

We see here with what pleasant relics the new age had to grapple.

There was also a constant state of war and jealousy between physicians, surgeons, apothecaries, and barbers, and although the physicians were a close corporation of great outward honour and dignity and learning, yet the slightest familiarity with the medical literature of the period leads one to speculate on the persistent pedantry of orthodoxy, and to feel relieved that one's interest in their writings and their treatment may remain anti-quarian and need never revert to a practical emergency.

There must, however, have been some good physicians, men of high sense of duty, possessed of shrewdness and common-sense, and natural kindness, who would think more of the idiosyncrasy of the patient and the merits of the case than of what Galen may have said about the subject. One remembers with affection that good man, Dr. Nathaniel Hodges, who did not flee from the City during the Plague of 1665, but remained to help the sick and dying.

It is now to the great exemplar of such good doctors that we turn when we name Thomas Sydenham (1624–89).

Sydenham is so simple, so English, and so straightforward, that at first, as we look through his books, we may miss the fact that he was great just because he was all those things at a period in the progress of medicine which needed him greatly.

He was primarily a product of Puritanism, that living acting moral force that gave birth to a great soldier in Cromwell, a great poet in Milton; a great prose-writer in Bunyan, and now a great physician in Sydenham. Let us, before speaking further of him, seize, if we can, some passage from his writings which will impress the heroic figure on our memories:

> It is my nature to think where others read; to ask less whether the world agrees with me than whether I agree with the truth; and to hold cheap the rumour and applause of the multitude. And what is it indeed? Is it any great thing for a man to do his duty as a good citizen, and to serve the public to his own private loss, and to take no glory for doing so? If I take a right measure of the matter, I am now so old that to study my own glory is to study the glory of a nonentity. What will it help me, after my death, for the eight letters which make the word SYDENHAM, to pass from mouth to mouth amongst men who can no more form an idea of what I was than I of what they will be; of men who will know none of these (then dead and gone) of the generation before them; of men who, from the inconstancy and vicissitude of all things human, will be changed in manners and changed in language!—(Dedication to his Treatise on the Gout, 1683. *Latham's translation.*)

Is there not an echo of the great stoic Emperor, Marcus Aurelius, in that? Both men were for the verities, and Sydenham here shows also that sense, so familiar to the reader of the *Meditations*, of the fleetingness of things.

Thomas Sydenham learnt his lessons in a hard school, the period of the Civil War. He was born at Wynford Eagle, in the county of Dorset, in 1624. The neighbourhood of Dorchester, and indeed much of Dorset, was strongly Parliamentarian, and Sydenham was brought up amid all the deep seriousness of the Puritans. His father was a landed gentleman, and fought when an elderly man as a captain in the army of the Parliament, and was taken prisoner. There is a deplorable story that Sydenham's mother was killed by the Royalists, but of this tragedy the details are not clear. It is also to our present purpose to note that the future physician had four brothers, who all held commissions under Cromwell. The eldest, Colonel William Sydenham, rendered great services, was a counsellor and friend of the Protector, and at the time of the Restoration was so eminent and marked a man that he was one of twenty persons named by the House of Commons to remain outside the scope of the Act of Indemnity "in all particulars not extending to life." Springing, as he did, from such

stock, there could be no doubt as to the bias of the young Thomas.

In 1642 at the age of eighteen he went to Oxford, and matriculated a Fellow Commoner at Magdalen Hall. But he was soon called away, and for nearly four years was engaged in military activities with his brothers in Dorset. In 1646 he returned to Magdalen Hall, but in 1647 he transferred himself to Wadham, to which in the following year, as we have already seen, the great Dr. Wilkins was to come as Warden. Sydenham, however, did not belong to the young Royal Society group, and seems in fact to have cared not much for these things. As we now have him here in Wadham we will pause for a moment and refer to the well-known fact that he paid little attention to the contemporary preoccupation with anatomy and physiology, and preferred to use what he considered better means for the understanding and cure of his patients. It must never be forgotten that Sydenham had been a soldier, and had been brought face to face with tragedy and the necessity for decisions, and that like many people he did not see much virtue in studies and enthusiasms in which he had no share. Sydenham's was not the purely scientific mind, which rarely seems to the outside world to occupy itself with things of the most urgent or practical importance. It is with a grim smile, therefore, that we read the following sentence, written some years later, by a man who was in the very thick of the Oxford of Boyle and Wilkins and Wren. It still exists, in Sydenham's own handwriting, among the Shaftesbury papers, and is a fragment of a treatise on medicine which he and his friend John Locke had planned to write together:

> Others have more pompously and speciously prosecuted the promotion of this art by searching into the bowels of dead and living creatures, as well sound and diseased, to find out the seeds of disease destroying them, but how with little success such endeavours have been and are likely to be attended, I shall in some measure make appear.

Nor is it with any graceless intent that we recount the well-known story that when many years later the young Sir Hans Sloane came to the great physician with a letter of introduction which described the bearer as "a ripe scholar, a good botanist, a skilful anatomist," Sydenham brushed all this aside and surprised the would-be disciple with "This is all very fine, but it won't do,—Anatomy-Botany. Nonsense! Sir, I know an old

woman in Covent Garden who understands botany better, and as for anatomy, my butcher can dissect a joint full as well; no, young man, all this is stuff: you must go to the bedside, it is there alone you can learn disease."

But Sydenham must always have been pretty sure of his ground, and as a corrective to these two utterances it is necessary here to quote a passage which occurs in his Treatise on Dropsy, which he published towards the end of his life, in 1683:

> Now, that there are secret passages thro' which the waters are convey'd from the cavity of the belly to the intestines is manifest; for daily experience shews that *hydragogues* carry off as much water downwards, as if it were originally contained in the intestines themselves. But as it is not easy to account for this fact, it brings into my mind an excellent passage of *Hippocrates*, who is universally esteemed the most knowing physician the world ever had. His words are these: "Some physicians and pretenders to learning, hold it impossible to understand physic, without being acquainted with the nature of the human body, in the manner of its formation; but, I am of opinion, that what philosophers and physicians have delivered concerning nature relates more to painting than to the art of medicine."
>
> But lest this admirable author should be accus'd of error, or empirics endeavour to patronize their ignorance from this passage, I freely own, that as far as I am able to judge of practice, which ought to be the test of physicians, it is absolutely necessary a physician should be well acquainted with the structure of the human body, to enable them the better to form right conceptions of the nature and causes of some diseases. For without a knowledge of the structure of the kidneys, and urinary passages, one cannot conjecture whence those symptoms arise, which proceed from a stone's being lodged in the *pelvis*, or sticking fast in the ureters. Surgeons likewise ought to understand *anatomy*, that they may more surely avoid those vessels, or parts in their operations, which cannot be hurt without destroying the patient. Neither can they reduce dislocated bones to their natural situation, without a careful examination and thorough knowledge of the position of the bones in a skeleton.
>
> Such knowledge of the human body, therefore, is so absolutely necessary, that whoever wants it will treat diseases hoodwinked. Besides, this science may be acquired without much trouble, and in a short time; for it may be sooner learnt than other more difficult matters by persons of no great acuteness, by inspecting the human body, or the bodies of some animals.—(*Swan's translation.*)

But we left Sydenham at the age of twenty-three at Wadham. He had by this time, as a result of a chance encounter with a physician on his journey to London on his way to Oxford for the second time, determined to adopt medicine as a profession,

and in 1648 he was created Bachelor of Medicine by special command of the Chancellor of the University, the Earl of Pembroke. Degrees were at times given in those days to persons considered worthy of them by the command of the King or the Chancellor or by vote of Convocation. Although in Sydenham's case the Earl of Pembroke's choice was a happy one, it cannot be supposed that the recipient's medical education had been much to speak of, for Oxford then was a centre rather for enthusiastic amateurs of medical research than of actual medical education, and Sydenham's life had been too profoundly disturbed by the realities to allow of close application to study.

Later on in the same year (1648) Sydenham was appointed to a Fellowship at All Souls, and in March, 1649, he was Senior Bursar. Sydenham's Oxford career will always afford a text for curious speculations on the subject of relative values. Did it or did it not seem extraordinary to Sydenham that at All Souls he had as a contemporary for a short time a young man named Christopher Wren? He did, however, form a lasting friendship with the Honourable Robert Boyle, to whom he afterwards dedicated his first book, that on the Method of Curing Fevers (*Methodus Curandi Febres*, London, 1665), and in the dedication he refers to Boyle's having accompanied him in visits to his patients.

But now once again we are faced by one explanation of why he could not find interest or satisfaction in the little world of scientific research which surrounded him, for in 1651 he once more left Oxford to go to the aid of that cause which would not let him rest. He had been financing his younger brother, Major John Sydenham, who had died of wounds in this same year 1651 after an engagement near Stirling, and about a month before his brother's death the Senior Bursar of All Souls had received "a commission in the first regiment of militia cavalry." So he left Oxford to the virtuosos. Cromwell was in Scotland, and Sydenham himself seems in the course of his military duties to have gone beyond the Border. But the "crowning mercy" of Worcester was in the same year, soon after which, it is to be presumed, Sydenham returned to his college. In 1655 he resigned his fellowship, and was married, down at Wynford Eagle, to Mary Gee.

This brings us to the beginning of Sydenham's professional career, for it is supposed that it was about the year 1656 that he began to practise in King Street, Westminster. His family had rendered great service to the Parliamentary Party, and it may

have been with some view to patients in the official world that Sydenham chose this neighbourhood.

But although ostensibly settled in practice, Sydenham appears during the next three years to have had second thoughts as to his vocation, for in 1658 he stood as candidate for Weymouth in the first Parliament of the younger Cromwell. In this he was unsuccessful, but in the following year 1659, he received from his political friends an official appointment called Comptroller of the Pipe. This had to do with the registration of Crown leases. But it was not a good time for a Parliament man to receive patronage, for the Restoration was perilously imminent. The eldest brother, Colonel William Sydenham, would be considered little better than a regicide, and for none of that family would any appointment be tenable. Whatever the physician's apprehensions were in the matter we cannot be certain, but it is almost proved that it was in the year 1659 he went to Montpellier to further his studies in medicine. Apart from the political situation, it is probable that the entirely conscientious Sydenham found his medical knowledge inadequate for practice, and he went for a short time to be a pupil of a famous Protestant physician named Barbeyrac, who although excluded on account of his religion from a professorship, had a large following of students. Barbeyrac seems to have influenced Sydenham profoundly, for John Locke, who was at Montpellier about the year 1675, and knew both men, is reported to have said "that he never knew two men more alike in opinions and character than these two physicians."

Sydenham was back in practice again by 1661, and in 1663 he received the Licentiate of the Royal College of Physicians. By the year 1667 he was living in Pall-Mall, and it was from there that, when he died in 1689, he was borne to the church of St. James's, Piccadilly.

"It is my nature to think where others read," we have heard him saying. But he is rather like the Pilgrim in Bunyan's allegory, for Sydenham, too, had one book, and the book in Sydenham's knapsack was Hippocrates. Sydenham does in a remarkable way present the medical equivalent of the Puritan ideal. At the commencement of his journey he accepted the fact that "the great Hippocrates arrived at the highest pitch of physick," and to the great model of Hippocrates, he, with simple clear-eyed faith, went back in an age of unparalleled expansion in physiological research. He looked neither to the right hand nor to the left, but was so strong in himself that he reimposed

the Hippocratic method on the future course of medicine. In an age of theories, mechanical and chemical, and of physiology leading men hardly knew where, the lesson of Sydenham was so absolutely salutary that his influence has lasted to this day, and wherever medicine is taught his example is followed and his name is honoured.

It is now desired to let Sydenham speak for himself, so that the reader may get some idea of the simplicity, the integrity, the *pietas* of this great Englishman. Much has been written about him, but his own words are less known than his great fame. It should be remembered, however, that he published all his books in Latin, and the present selections are taken from the good idiomatic translation by Dr. John Swan, first published in 1742 by Edward Cave at St. John's Gate, Clerkenwell. The name of Cave reminds us of the young Samuel Johnson, and to this English edition there is prefixed a brief Life of Sydenham by Johnson, reprinted from the *Gentleman's Magazine*. Before, however, commencing a series of quotations it must be stated in what special fields Sydenham cultivated the Hippocratic grain.

What Sydenham, at the end of some centuries of interminable treatises and scholastic theories, saw with clearness of mind was that the physician had, after all, to get back to the bedside, and that the recovery of the patient must be largely an affair of Nature's, aided by such steps on the part of the physician as were prompted by direct observation and his own fund of experience. He must not attempt the cure on any academic hypothesis unrelated to the individual case before him, and if a course of treatment did not at once suggest itself, the physician must have the humbleness of mind to "wait a little" till the progress of the malady showed him what had best be done. "The lustre and excellence of the art of medicine," he says, "are not so clearly seen in elegant prescriptions, as in curing diseases."

Next Sydenham regarded a disease as an ordered process of Nature, "a vigorous effort of Nature to throw off the morbific matter." He therefore set out to observe these vigorous efforts of Nature; and to write down what he saw, so that he should accumulate a body of direct evidence to be of future use to himself and to others, in much the same way as the botanists of that period, who were just then very busy at Oxford, were endeavouring to describe and give exact representations of the plants and flowers. Sydenham, in fact, remembers them, and writes:

> For, is there a shorter, or indeed any other way of coming at the morbific causes we are to encounter, or of discovering the curative indications, than by a clear and distinct perception of the peculiar symptoms? Even the smallest circumstance is of use to both these purposes. For allowing that some variety happens from the constitution of particular persons, and the method of cure, yet nature notwithstanding acts in that orderly and unchangeable manner in producing distempers, that the same disease appears attended with the like symptoms in different subjects: so that those which were observed in *Socrates*, in his illness, may generally be applied to any other person, afflicted with the same disease, in the same manner as the general marks of plants justly run thro' the same plants of every kind. Thus for instance, whoever describes a violet exactly as to its colour, taste, smell, form, and other properties, will find the description agree in most particulars with all the violets in the universe.

Concurrently with this clinical bias, Sydenham was interested in epidemics and in the diseases which in those days were known as fevers, and while Pepys was keeping his Diary (1659-69), Sydenham was writing almost as exact an account, season by season, of the epidemics in London from 1661 to 1675. In the matter of epidemics and their causes Sydenham's theories were largely Hippocratic, and he cannot be blamed for not being in a position to apply to them the results of research since his day. By some irony of circumstance he was absent from London during the Great Plague, and consequently he has not left us any full account of that great epidemic for the description of which much of his life had been a preparation. His practice lay in Westminster. The Court had left London, his patients had fled the town, and now, remembering June 1665, he writes: "But when there was danger from the near approach of the *plague* to the house wherein I lived, yielding at length to the solicitations of my friends, I accompanied the vast numbers that quitted the city, and removed my family some miles distant from it. But I returned to town in so short a time, and whilst the *plague* yet raged so violently, that on account of the scarcity of abler physicians I could not avoid being called to assist the affected." But he has left no account of the dire distress of that black year as did Dr. Nathaniel Hodges and William Boghurst, an apothecary. The theories of epidemics and fevers have changed since Sydenham's time, but his faithful descriptions have a classic value as examples of exact observation, and he may be regarded as the founder of the modern science of epidemiology.

Sydenham's third great contribution to medical science lies in his vivid first-hand accounts of certain diseases. From the age of thirty he suffered from gout, and his Treatise on the Gout (*Tractatus de Podagra*, 1683) is the record of a sufferer, and reads with something of the speed of a narrative. What acute personal experience is apparent in this observation:

> The chillness and shivering abate in proportion as the pain increases, which is mild in the beginning, but grows gradually more violent every hour, and comes to its height towards evening, adapting itself to the numerous bones of the *tarsus & metatarsus*, the ligaments whereof it affects; sometimes resembling a tension or laceration of those ligaments, sometimes the gnawing of a dog, and sometimes a weight and constriction of the membranes of the parts affected, which becomes so exquisitely painful, as not to abide the weight of the cloths, nor the shaking of the room from walking briskly therein.

In Sydenham's pages are to be found new and exact descriptions of fevers, gout, scarlatina, measles, bronchopneumonia, pleuropneumonitis, dysentery, chorea, and hysteria. These have served as models for the clinician and pathologist ever since.

> " A disease, in my opinion," Sydenham begins, "how prejudicial soever its causes may be to the body, is no more than a vigorous effort of Nature to throw off the morbific matter, and thus recover the patient. . . . Now I judge that the improvement of physick depends (1) upon getting as genuine and natural a description, or history of all diseases, as can be procured, and (2) a fix'd and complete method of cure."

But the physician must approach his case with an open mind:

> In writing, therefore, a history of diseases, every philosophical hypothesis which hath prejudic'd the writer in its favour ought to be totally laid aside, and then the manifest and natural phenomena of diseases, however minute, must be noted with the utmost accuracy; imitating in this the great exactness of painters, who, in their pictures copy the smallest spots or moles in the originals. For 'tis difficult to give a detail of the errors that spring from hypotheses, whilst writers, misled by these, assign such phenomena for diseases, as never existed, but in their own brains; whereas they ought to appear clearly, if the truth of the hypothesis, which they esteem fixed and certain, were well established. Again, if any symptom properly suiting their hypothesis, does in reality belong to the disease, to be describ'd, they lay too much stress upon it, as if it were every thing they wanted, whereas, on the contrary, if it seems repugnant to their hypothesis, their manner is,

either to take no notice at all of it, or but barely to mention it, unless they can by means of some philosophical subtlety, adjust it thereto, and bring it in some measure to answer their end.

And on this subject of hypotheses he says:

But tho' all *hypotheses* founded on philosophical reasonings are quite useless, since no man is possess'd of intuitive knowledge, so as to be able to lay down such principles as he may immediately build upon, yet when they result from facts, and those observations only which practical and natural phenomena afford, they will remain fixed and unshaken: so that though the practice of physic, in respect of the order of writing, may seem to flow from *hypotheses*, yet if the hypotheses be solid and true, they in some measure owe their origin to practice. To exemplify this remark: I do not use chalybeates and other medicines that strengthen the blood, and forbear evacuants in *hysteric* disorders, (unless in some particular cases where I rather exhibit opiates) because I first took it for granted, that these complaints arose from the weakness of the animal spirits; but when I learnt from a constant observation of practical phenomena, that purgatives always increas'd the symptoms, and medicines of a contrary kind always quieted them, I deduced my hypothesis from this and other observations of the natural phoenomena, so as to make the philosopher in this case subservient to the empiric. Whereas to have set out with an hypothesis would have been as absurd in me, as it would be in an architect to attempt to cover a house before he had laid the foundation, which only those who build castles in the air have a privilege of doing, as they may begin at which end they please.

And again:

As to those *chronic diseases*, the history whereof I promised you to write, my thoughts are so fully turned that way, that I wish my life may be prolonged for this reason chiefly, that, by an attempt of this nature, I may be serviceable to mankind. But the experience of every day convinces me how difficult and hazardous an undertaking this is, especially for me, whose abilities are unequal to the task; for among medicinal writers, excepting *Hippocrates*, and a very few others, we meet with little to direct the mind in its enquiries into so intricate a subject; the assistance and light which authors promise, being rather false than true lights, which tend to mislead, and not to direct the mind in its researches after the genuine procedure of nature. Most of their writings are founded upon *Hypotheses*, which are the result of a luxuriant imagination; and the symptoms of diseases (wherein their true history consists) as described by them, appear to be deduc'd from the same source; and the method of cure, also, is deriv'd from the same fictitious principles, and not from real facts, and thus becomes most destructive to mankind: so full of specious reasonings is every page of the writings of such superficial men, whilst the directions of nature are overlooks.

He is never deceived by the supposition that he has discovered "a fixed and complete method of cure" for a disease, for he confesses with his fine modesty that in his first case of dropsy (he is writing twenty-seven years later), that of Mrs. Saltmarsh, of Westminster:

> Being young and unexperienced, I could not help thinking that I was possess'd of a medicine, effectual for the cure of any kind of *dropsy:* but in a few weeks I discovered my error. For being called afterwards to another woman afflicted with the *dropsy,* which succeeded an inveterate quartan, I gave this syrup and repeated it frequently, increasing the dose by degrees; but having ineffectually attempted to evacuate the waters, inasmuch as the medicine did not operate, the swelling of the belly increased, and she dismissed me; and, if my memory does not fail me, recovered by the assistance of another physician, who administer'd more efficacious remedies.

He is always insistent that the physician shall be but the assistant at Nature's mysteries, and to this purpose he cites his master, Hippocrates:

> By these steps and helps the great *Hippocrates* arrived at the highest pitch of physick, who, after laying down this solid and fixed foundation to build the art upon, has clearly delivered the symptoms of every disease, without deducing them from any hypothesis, as appears in his books concerning *diseases,* &c. He has likewise left us some rules drawn from the observance of nature's method of promoting and removing distempers; such are his *prognostics, aphorisms,* and other writings of this kind. Of these particulars the theory of this venerable father of physick chiefly consisted, which not being deducted from the insignificant sallies of a wanton imagination, like the dreams of distempered persons, exhibited a genuine history of the operations of nature in the diseases of mankind. Now his theory being no more than an exact description of nature, it was highly reasonable that he should aim in his practice only at relieving diseased nature by all the means he could emply; and hence, likewise, he required no more of art, than to assist nature when she languish'd, and to check her, when her efforts were too violent; and to accomplish both these ends by the steps and method whereby she endeavours to expel the disorder: for this sagacious observer found that nature alone terminates distempers, and works a cure with the assistance of a few simple medicines, and sometimes even without any medicines at all.

So he wishes, as far as possible, not to interfere with Nature, but to let her take her course, and in the following passage we hear him expounding that doctrine for which he is especially

famous, the doctrine of treatment by expectation, or wait and see:

> And indeed, if I may speak my sentiments freely, I have long been of opinion, that I act the part of an honest man, and a good physician, (not only in these diseases of child-bed women, but likewise in all acute diseases, where I cannot certainly promise that the method I make choice of will perform the cure) as often as I refrain entirely from medicine, when upon visiting the patient I find him no worse to-day than he was the day before, and have reason to suppose he will be no worse to-morrow than he is to-day. Whereas, if I attempt to cure the patient by a method, which I do not yet know to be effectual, he will be endangered, both by the experiment I am going to make upon him, and the disease itself; nor will he so easily escape two dangers as one. For tho' at present there appears no manifest sign of his amendment, yet it is certain, that the nature of an acute disease is such, that it cannot always last; and besides, every day will lessen the danger, or at least, afford the physician a more favourable opportunity, of conquering the disease, than he had before.

And again, on the same subject, how refreshing is this after the futile vapourings of his forbears:

> Under so much darkness and ignorance, therefore, my chief care, as soon as any new fever arises, is to wait a little, and proceed very slowly, especially in the use of powerful remedies; in the mean time carefully observing its nature and procedure, and by what means the patient was either reliev'd or injur'd; so as soon to embrace the one, and reject the other.

For his medicines Sydenham forsook the loathsome and elaborate remedies of his time, and used simples. Even so, to the modern mind, some of his prescriptions are very long, but it is reassuring after an acquaintance with the generality of seventeenth century prescriptions, to read over one of his shorter ones. Herrick might have turned it into verse:

> Take of cowslip flowers, one handful; boil them in enough black-cherry water to leave three ounces, when strained off, to which add syrup of white poppies, half an ounce; juice of lemons, half a spoonful; mix the whole together.

Sydenham was always a close observer and recorder of what he would have called the natural history of epidemics. Of the Cholera Morbus he says very confidently, "It comes almost as constantly at the close of *summer*, and towards the beginning of *autumn*, as swallows in the beginning of *spring*, and cuckows

towards *midsummer*." He first described and indeed named scarlet fever, and his description if it must serve as our one example of the entire series of those classic descriptions which have been read and re-read by generations of physicians all over the world:

> Tho' the *scarlet fever* may happen at any time, yet it generally comes at the close of summer, when it seizes whole families, but especially children. (1) A chilness and shivering come at the beginning, as in other fevers, but without great sickness; (2) afterwards the whole skin is covered with small red spots; which are more numerous, larger, and redder, but not so uniform as those which constitute the measles; (3) they continue two or three days, and after they are vanish'd, and the skin is scaled off, there remains a kind of branny scales, dispersed over the body, which fall off, and come again for twice or thrice successively.
>
> As this disease seems to me to be nothing more, than a moderate effervescence of the blood, occasioned by the heat of the preceding summer, or some other way, I do nothing that may prevent the despumation of the blood, and the expulsion of the peccant matter thro' the pores, which is quickly enough perform'd. Accordingly, I refrain from bleeding, and the use of glysters, which make a revulsion, whereby I conceive the noxious particles are more intimately mixed with the blood, and the motion which is more agreeable to nature is check'd. On the other hand I forbear cardiacs, by the heat of which the blood may perhaps be put into a more violent motion, than so gentle and mild a separation as effects the cure requires; and besides by this means a high fever may be occasioned. I judge it sufficient for the patient to refrain wholly from flesh, and all kinds of spirituous liquors, and to keep his room, without lying always in bed. When the skin is entirely peeled off, and the symptoms vanished, 'tis proper to give a gentle purge, suited to the age and strength of the patient. By this plain and manifestly natural method, this disease in *name* only, for 'tis little more, is easily cured, without trouble or danger. Whereas on the contrary, if we add to the patient's evils, either by confining him continually in bed, or exhibiting abundance of cardiacs and other superfluous remedies, the disease is immediately augmented, and he frequently falls a victim to the over-officiousness of the physician.
>
> But it should here be observed, that when epilectic *convulsions*, or a COMA, arise in this disease at the beginning of the eruption, which sometimes happens to children and young persons; 'tis highly proper to apply a large and strong epispastic to the neck, and immediately exhibit a paregoric of *syrup of white poppies*, which is to be repeated every evening during the illness; and he must be directed to make use of milk, boiled with thrice its quantity of water, for his ordinary drink, and to refrain from flesh.

One of his more general descriptions must be given. What could be more exact, more true to what most people know at

some time or other as life, than the following masterly passage on melancholia?

> But their misfortune does not only proceed from a great indisposition of body, for the *mind* is still more disordered; it being the nature of this disease to be attended with an incurable *despair;* so that they cannot bear with patience to be told that there is hopes of their recovery, easily imagining that they are liable to all the miseries that can befall mankind; and presaging the worst evils to themselves. Upon the least occasion also they indulge terror, anger, distrust, and other hateful passions; and are enemies to joy and hope; which if they accidentally arise, as they seldom do, quickly flie away, and yet disturb the mind as much as the depressing passions do, so that they observe no mean in any thing, and are only settled in inconstancy. They love the same persons extravagantly at one time, and soon after hate them without a cause; this instant they propose doing one thing, and the next change their mind, and enter upon something contrary to it, but without finishing it; so unsettled is their mind, that they are never at rest.
>
> What the *Roman* orator asserts of the superstitious, agrees exactly with these melancholic persons. *Sleep seems to be a relief from labour and inquietude, but from this many fears and cares arise;* their dreams being ever accompanied with the representation of the funerals and apparitions of their departed friends. And so much are they distempered in body and mind, that it seems as if this life were a purgatory, to expiate offences committed in a pre-existent state.
>
> Nor is this the case only in furious maniacs, but even in those, who, excepting these violent passions, are judicious persons, and for profoundness of thought, and solidity of speech greatly excel those whose minds were never disturbed by these tormenting thoughts. So that the observation of *Aristotle* is just, who asserts that *melancholy persons are the most ingenious.*

Occasionally that sense of humour which forms the basis of the amusing collection of anecdotes about Sydenham breaks out in his medical writings. He has just described his cure, by a diet of whey, of the rheumatism of Mr. Malthus, the apothecary, the ancestor of a more famous Malthus. In the last sentence he might almost be smiling at the literary felicities of Sir Thomas Browne:

> If any one should lightly esteem this method, on account of its inelegance and plainness, I must tell him, that only weak minds slight things because they are common and simple; and that I am ready to serve mankind, even at the expence of my reputation. And I must add that, were it not for the prejudice of the vulgar, I am certain that this method might be suited to other diseases, which I shall not now enumerate. And in reality it would be

much more serviceable than the pompous garlands of medicines, with which such as are ready to expire are crowned, as if they were to be sacrificed like beasts.

We have given much space to Sydenham for two reasons. Firstly, because he is usually passed over quickly in books with some ready phrase like "the English Hippocrates"; and secondly, because as he made no great medical discovery it is not easy to understand why he was one of the greatest of English physicians unless one gets to know something of the man himself.

There were certain other reforms which he introduced into English practice, as well as certain other traits of character, which should be mentioned. He, though no believer in specifics, gradually came to make increasing use of the Peruvian bark, or cinchona, then a recent innovation in this country. He insisted on fresh air in sick-rooms, and he introduced the cooling method in small-pox. He never tires of recommending horse-riding, especially for consumptives. The right beverage for Sydenham and for all his patients was small beer. Apparently he distrusted London water. Finally, he must have possessed that first qualification for a true physician, the virtue of abiding and deep friendship. See how he never fails to refer to his friend Dr. Goodall unless in terms of admiration and affection, and this is how he concludes a letter to his friend John Locke, who had consulted him about his health:

> This is all that I have to offer you and I have thought of it, and all the circumstances relating to your case, with the same intention of mind as if my life and my son's were concerned therein.
>
> T.S.

But we would fain follow him once more to one of his consultations, in the sure hope of hearing in the course of it some good English thing. Nor are we disappointed. He knows how to deal with the Lords Spiritual:

> To produce an instance of its efficacy, a reverend and learned prelate having applied himself too intensely to his studies for a long time, was at length seized with an hypochondriac disorder, which, by its long standing, deprav'd all the ferments of the body, and destroy'd the digestions. He had gone through some courses of chalybeates and tried most mineral waters, with repeated purgation, all kinds of antiscorbutic medicines, and abundance of testaceous powders, which bid fair for sweetening the blood. Being thus in a manner worn out, partly by the disease, and partly by the continued use of remedies for so many years; he was at length

> attacked with a *colliquative looseness*, which is the usual fore-runner of death in *consumptions* and other chronic diseases, when all the digestive faculties are totally destroyed At length he consulted me, and I immediately judged there was no further place for medicine, as he had taken so many ineffectually; and therefore advised *riding on horseback;* directing him to take only such short journeys at first, as might best suit his weak condition. Had he not been a judicious and considerate person, he could not have been persuaded to try this kind of exercise. I intreated him to continue it every day till he found himself perfectly recovered; and to lengthen his journeys by degrees to a moderate day's journey, and not to mind either meat or drink, or the weather, but to take up with such accommodations as were to be met with upon the road, like a traveller. In short, he continued, this method till at length he rode twenty or thirty miles a day, and finding himself much amended in a few days, he was encouraged by this wonderful success to continue this course for several months, in which space of time he told me he had rode many thousand miles, so that at length he was not only freed from his disorder, but became strong and brisk.

So here, out in the English air, we will leave Thomas Sydenham.

We have now come to the end of that period which was the rich and fertile field which divided the domains of the old and the new worlds of medical knowledge. We have attempted only to indicate, with a little more detail than is usually possible in short histories of medicine, the general trend of ideas and action in this period. The lesser men, the men, however who did so much important work, we have had to leave for the curiosity of the reader to explore for himself.

There were, however, three further tendencies which must be indicated. For the first, one name must suffice. Theophilus Bonetus (1620–89), who was born in Geneva, and was physician to the Duc de Longueville, made a vast collection of all the accounts of post-mortem examinations of the past centuries of which he could obtain records, and published this great corpus, or rather cadaver, of knowledge, in two large folio volumes, Geneva, 1679. To his book he appropriately gave the name of *Sepulchretum Anatomicum.* We see here the tendency which was to be the foundation of modern pathology and morbid anatomy: the observation of morbid change which was to be developed as never before in the next century.

This period saw also the beginning of the science of vital statistics and the application of the principles of political economy to medical knowledge. John Graunt (1620–74), a

London haberdasher, wrote *Natural and Political Observations upon the Bills of Mortality* (London, 1662). He was elected a Fellow of the Royal Society. His friend, Sir William Petty, a physician, wrote various books on political economy, and he and Graunt may be considered the founders of one of the most important and fruitful aids to medical progress.

We now see also the publication of monographs or separate books on some special subject. We have mentioned already Richard Lower's book on the Heart (*De Corde*, 1669). Of outstanding and classic importance in the medical literature of the seventeenth century is the book on Rickets (*De Rachitide* 1650, English translation, 1651) by Francis Glisson, Regius Professor of Physic at Cambridge. There was the first great book on consumption by an Englishman, the *Phthisiologia* (1689, English translation, 1694) of Richard Morton, on whose blue flagstone memorial in the middle aisle the reader may find himself standing if he wanders into Wren's Christ Church, Newgate Street. We will add the important book by Thomas Willis on the Brain (*Cerebri Anatome*, 1664) if only to express the hope that successive historians of medicine will some day leave off describing this great man as "a fashionable physician".

We have seen, then, in this century an expansion in knowledge which resembled a series of miracles. Men have joined together, both in England, and in similar movements on the Continent, to reap the harvest of exact research. Harvey has freed medicine for ever from its chains. We have seen science assuming the insignia of precision. A new world has been laid open to the eye, and new instruments and methods have been brought to the service of the brain. Finally, in Sydenham, we have seen the nobility and eternal value of the human qualities put freely at the service o suffering mankind, and acting as a kind of wholesome check on the physiological tendency of the age.

It was the seventeenth century which was the crucial, the decisive century for modern medicine.

CHAPTER XVI

THE EIGHTEENTH CENTURY, AN ERA OF HYGIENE

IN THE year 1700 there was published at Padua a book with the title *De Morbis Artificium Diatriba*, a Treatise on the Diseases of Tradesmen. Its author was Bernardino Ramazzini (1633–1714), who was then Professor of Medicine at Padua. It would be unphilosophical, because a book on a new subject happens to be published in an Italian city in the first year of the eighteenth century, and written by a man whose life belonged more to the seventeenth than to the eighteenth century, to say: "In this book we see the new spirit, and the herald of fresh needs and new problems in medicine." But we can afford to wait a few years till the century has begun to show what course of development it is to take, and now, in 1746, we find Dr. Robert James, a learned man, whose Powders happened to turn out unfortunately for Oliver Goldsmith, translating Ramazzini's book into English. If the reader should ever meet with this little book, he will be charmed to accompany Ramazzini on his tour from shop to shop, from trade to trade, and to hear his wise and picturesque remarks about the ill effects that each trade has on its devotees. Even the unhappy writers are diagnosed at the end. It is really better to be idle, one begins to feel. Trade means discomfort, disease, and sometimes death.

In the eighteenth century began the modern era of trade and industry, and almost before they knew it, the physicians had to begin to grapple with problems connected with larger towns and a more standardized life. The England of Gray's Elegy saw the beginning of the factory. In a word, we start the battle for Hygiene.

Ramazzini's was the first book of its kind, but the literature of Industrial Diseases, of which it is the direct parent, is now enormous. We will quote Dr. James's translation of a passage from Ramazzini's preface:

> The Divine Hippocrates informs us, that when a Physician visits a patient, he ought to inquire into many things, by putting Questions to the Patient and the Bystanders. "When you come to a sick

> Person," says he, "you must ask what Uneasiness he is under, what was the Cause of it, how many Days he has been ill, how his Belly is affected, and what Food he eats": To which I would presume to add one Interrogation more; namely, "What Trade he is of." For though this Question may be referred to the Morbific Causes, yet I reckon it very convenient, and absolutely necessary, when we have to do with vulgar ordinary Patients: But I find it very seldom minded in the common Course of Practice, or if the Physician knows it without asking he takes but little notice of it: Though at the same Time a just Regard to that, would be of great Service in facilitating the Cure. So, I choose to publish this Treatise of mine for the good of the Republic, or at least for the benefit of Tradesmen: And though it is not very artfully writ, I hope the Reader will vouchsafe it a civil Reception.

Humanity can be taught only by hard knocks, and it is the reaction to these blows that causes the growth of effort to stem the tide of misfortune. We have seen in the Middle Ages what terror man was always in from the constant threatenings of plague and pestilence. In 1665 the plague was in London. In 1720 it was in Marseilles. They did all they could by means of quarantine of ships, the burning of great fires in the streets, and the hounding about of beggars, to arrest the contagion. In truth, who knew in those days whether the contagion was in the air or in the individual?

They begin to get alarmed in London. Plague might be lurking down there in those bales below Bridge. Mr. Secretary Craggs, at the command of the Government, writes to Dr. Richard Mead, a sound physician, the greatest collector and virtuoso and patron of the arts of his time, and a great and impressive figure in the medical world, for advice concerning preventive measures. Mead replies in a pamphlet called *A Short Discourse Concerning Pestilential Contagion* (1720), which he afterwards extended into a book. Mead recommends quarantine, and various measures of precaution. But what we wish to do here is not so much to dwell on the temporary scare, or to extricate the contemporary view of contagion, as to exhibit by the following passages from Mead his admirable prevision, or almost prophecy, of what was to develop as the English Public Health System:

> As the Plague always breaks out in some particular Place, it is certain, that the Directions of the *Civil Magistrate* ought to be such, as to make it as much for the Interest of Families to discover their Misfortune, as it is, when a House is on *Fire*, to call in the Assistance of the Neighbourhood: Whereas on the Contrary, the

Methods taken by the Public, on such Occasions, have always had the Appearance of a severe *Discipline*, and even *Punishment*, rather than of a *Compassionate Care:* Which must naturally make the Infected conceal the Disease as long as possible.

He then deprecates the isolation of infected families in their houses, but recommends humanitarian health officers. We seem really to recognize here the modern relieving officer:

Instead of *ignorant old Women*, who are generally appointed *Searchers* in Parishes to enquire what Diseases People dye of, That *Office* should be committed to *Understanding and Diligent Men*, whose Business it should be, as soon as they find any have dyed after an uncommon Manner, particularly with livid Spots, Buboes, or Carbuncles, to give Notice thereof to the Magistrates; who should immediately send skilful Physicians to visit the Houses in the Neighbourhood, especially of the *Poorer* sort, among whom this Evil generally begins; and if upon their Report it appears, that a Pestilential Distemper is broke out among the Inhabitants, They should without Delay order all the Families, in which the Sickness is, to be Removed; The Sick to different Places from the Sound; but the Houses for both should be three or four Miles out of Town; and the Sound People should be *stript of all their Cloaths*, and *washed* and *shaved*, before they go into their new Lodgings.

When the *Sick Families* are gone, all the goods of the Houses, in which they were, should be burnt; nay the Houses themselves, if that can conveniently be done. And after this all possible Care ought still to be taken to remove whatever Causes are found to breed and promote *Contagion.* In order to do this, the *Overseers* of the Poor (who might be assisted herein by other Officers) should visit the Dwellings of all the meaner sort of the Inhabitants, and where they find them *stifled up too close and nasty*, should lessen their Number by sending some into better Lodgings, and should take Care, by all Manner of Provision and Encouragement, *to* make them more *cleanly* and *sweet.*

At the same time, that this Care is taken of *Houses*, the proper Officers should be strictly charged to see that the *Streets* be washed and kept clean from *Filth*, *Carrion*, and all Manner of Nusances; which should be carried away in the Night Time; nor should the *Laystalls* be suffered to be too near the City. *Beggars* and *Idle Persons* should be taken up, and such miserable Objects, as are neither fit for the common *Hospitals*, nor Work-houses, should be provided for in a *Hospital of Incurables.*

Orders of this kind are necessary, to be observed at all times, especially in Populous Cities; and therefore I am sorry to take Notice, that in *these* of *London* and *Westminster* there is no good *Police* established in these Respects; for want of which the Citizens and Gentry are every day annoyed more ways than one.

It is scarcely necessary to remind the reader that we are now in the age of Mr. Alexander Pope. He is living at Twickenham

among his grottoes. On the twelfth of December, 1743, the year before he died, he made his will, and it was witnessed by the Earl of Radnor, Joseph Spence, Professor of History at Oxford, and Stephen Hales, Minister of Teddington.

It is Pope's neighbour, Stephen Hales (1677–1761), who next occupies us. He was also Rector of Farringdon, in Hampshire, of which village a little later in the century Gilbert White was to be the curate. Is it not a curious coincidence that the little Hampshire village should be associated in a spiritual way with our first great naturalist and one of our greatest physiologists? For that was what Hales was. He has been called, but a little absurdly, when we remember the seventeenth century, the Father of Physiology. He was, however, one of those devoted and inspired lay-workers in the world of science, who from time to time do work that raises them and science to the heights. We must not stay over the physiological achievements of Hales except to give ourselves the pleasure of quoting a few words from Professor J. F. Fulton: "Stephen Hales, the 'perpetual curate' of the parish of Teddington in the county of Middlesex, occupied himself between his sermons with a series of observations on the mechanics of the circulation, which rank in importance with the studies of Harvey . . . The experiments . . . were carried out alone and unassisted in a country parsonage after he left Cambridge in 1709, and they remained unpublished for a period of nearly twenty years." And again: "No one approached Hales in experimental technique or in his faculty of planning brilliantly conceived experiments until the days of Ludwig, more than one hundred years later, and in this interval very little of moment was added to the knowledge of the circulation."

But Hales was also one of our best and earliest hygienists, as he occupied himself with problems of water supply, the preservation of food at sea, the ventilation of houses and ships, and we might add, the promotion of temperance. In Hales we may note the beginning of that interest in the care of the health of sailors which is one of the good things of the eighteenth century.

Hales's *Description of Ventilators* (1743) describes his apparatus, which was a "Box-like Bellows for drawing out the Foul Air," and this book is the foundation of modern ventilation. The Ventilator could be used both in houses and ships. It was adopted at Newgate, where it reduced the death-rate from eight to two per month. The French applied the system in their prisons for British prisoners.

It is difficult not to quote Horace Walpole's wicked description of Hales as "a poor, good, primitive creature," but better to remember Pope's "I shall be very glad to see Dr. Hales, and always love to see him; he is so worthy and good a man."

There was about this time another ventilating device. Samuel Sutton published in 1745 *An Historical Account of a New Method for Extracting the Foul Air out of Ships, &c.* This apparatus was sponsored by Mead and was adopted by the Navy.

We have next to consider a true follower of Sydenham, John Huxham (1692–1768), who practised at Plymouth. In his *Essay on Fevers* (1739) he says of Hippocrates: "I will not take upon me to say a person cannot be a good physician without consulting that great oracle of physic and reading the ancients, but this let me say, he will make a much better physician for so doing, and I believe few, if any, ever made any considerable figure in the profession who had not studied them." Sydenham would have approved of this praise of his master, and next we see Huxham treading in the footsteps of Sydenham, but a little more on this side of modernity, and keeping for almost thirty years (1724–52) daily records and observations on the weather, with the object of ascertaining the relation of weather conditions with epidemics and prevailing sicknesses. It reminds us of Sydenham's devotion to epidemics, and the interests and methods of both men can clearly be associated with Hippocratic thought. Huxham's book was first published in Latin, but there is an English translation, *Observations on the Air and Epidemic Diseases* (London, 1759). In this work of Huxham's we see those tendencies towards patient records and observation which have played so great a part in subsequent developments in Public Health reform.

In 1739 Huxham published his most famous book, the *Essay on Fevers*. In this work, as Dr. F. G. Crookshank (*Influenza*, London, 1922) points out, we have the first allusion to Influenza by that name by an English physician. Huxham says in the Second Edition of this book, 1750, "I well remember that the catarrhal Fever which spread through all Europe under the Name of *Influenza* in the spring, 1743, frequently became pleuritic, or peripneumonic, and, as frequently, after two or three days, ran into a Quotidian or Tertian." He thus antedates Pringle, to whom the naming of Influenza is often ascribed, by two years. In this book also Huxham distinguished between what we now know as typhus and typhoid, for as Sir William Osler says, he had "taken notice of the very great difference

there is between the putrid malignant and the slow nervous fever."

Huxham lived in the West of England, the cider country, and he was thus forced to observe the ravages of a very serious epidemic of colic which attacked the inhabitants each year. In the year 1724 he saw the colic at its worst, and published an account of it in Latin. There is an English translation at the end of his *Observations on the Air* (1759). He tells us in "A Short Dissertation on the Devonshire Colic" that:

> In the beginning of the Autumn, 1724, a Disorder exceedingly epidemical, spread itself all over the county of Devon, amongst the Populace especially, and those who were not very elegant and careful in their Diet. . . . Though it may not rage with the same Degree of Violence, and affect a vastly less Number of People, yet it infests this Country more or less almost every Autumn.
>
> Such an incredible Quantity of Apples we had that year, greater indeed by much than was ever known in the Memory of Man, at least in this Country.
>
> The lowest Sort of People fed almost intirely upon them: Apples in one Form, or Another, were in all their Diet; Cyder (I should rather call it Must) was all their Drink, for this being cheaper than the smallest Beer, indeed almost as easily procured as Water, and yet far more grateful, the joyful Populace drank abundantly, ignorant of the future ill consequence.

And he says of the epidemic Colic:

> There was scarce a Family amongst the lower Rank of People that had it not—nay I have often seen five, or six, lying ill of it in one and the same House.

It was a terrible complaint, and sometimes terminated in palsy or epilepsy. Huxham does all he can to find out the cause, and at length blames the juice of the apple:

> Nay Cyder made of the very sour and acerb kind of Apples is neither a grateful or healthy drink till after the second or even the third Year. If you drink either of those Liquors too new you will be certainly plagued with colical and rheumatic pains.

This great and sound physician then relapses at great length into what is, to us, nonsense:

> By long and frequent drinking a liquor of this kind, such a quantity of crude, gross tartar is thrown into the blood, that it thence becomes very acrid; and not only the blood, but, from that impure source, all the humours thence secreted.

He then proceeds to give his method of treatment.

What Huxham did not know was that the cause of the trouble was not the tartar in the apple, but lead poisoning.

The mystery was solved a few years later by Sir George Baker (1722–1809), a Devonshire man, who later became President of the Royal College of Physicians. His *Essay Concerning the Cause of the Endemial Colic of Devonshire*, 1767, is accounted one of the masterpieces of medical reasoning, and it set the first great example in this country of how an epidemic or a disease should be tracked down to its source. "We have now learned," he says early in his essay, "not to indulge ourselves in visionary speculations, but to attend closely to nature."

Baker had noticed that the symptoms of the Devonshire colic were identical with the ill effects caused by lead poisoning, and he noticed also that it was the same disease as the ancient colic of Poitou, which had been proved to be caused by the vintners, who, "in order to correct their sour, austere wines, and make them more palatable, had practised a method of mixing litharge with them." Huxham had also seemed aware of the similarity of the Devonshire colic to the colic of Poitou, but had missed the point with regard to the lead. Sir George Baker says, early in his essay:

> When I consider that this colic of Devonshire is precisely the same disease, which is the specific effect of all saturnine preparations; and that there is not the least analogy between the juice of apples, and the poison of lead; it seems not to me probable that two causes, bearing so little relation to one another, should make such similar impressions on the human body.
>
> But, lead itself being certainly of such a nature, as to be abundantly answerable for all the ill effects, complained of from the cyder my thoughts were naturally carried to the search of it; and well might I expect to find it, in some way or other, combined with that liquor.

Far on in his essay he quotes Vitruvius and Galen to show that the ancients were aware of the danger of lead piping for carrying water, and this fact we have referred to in an earlier chapter (page 82).

But Baker does not stop satisfied at his hypothesis, and accept it as a fact. He proceeds to the most minute and masterly investigation of the cause of the Devonshire colic, and especially makes great use of the fact that the people of Herefordshire, Worcestershire, and Gloucestershire, cider countries, do not suffer from the colic. So that Huxham's theory of the tartar

in the apples corrupting the bile becomes untenable. But the matter does not end so easily here, and Baker, with immense patience, and all his powers of reasoning and comparison and elimination, and finally by chemical analysis, proves that there is lead in the cider, and that the lead comes from various parts of the apparatus in which the cider is made or in which it is afterwards stored. We have space here to do but poor justice to the exquisite logic, the irresistible argument, and the fine scholarship of Baker's essay. It must be said, however, that in it we have an example of all that is best in the early literature of investigation into the causes of epidemic or industrial diseases, and that it is not only a shining example, but is the first landmark in that literature.

If we now open two eighteenth-century books, one on military, the other on naval, hygiene, we shall not only gain insight into what might be called the domestic economy of the lives of British soldiers and sailors, but we shall actually be present at the painful and desperate inauguration of the fight for wholesome conditions in the two services.

The first of these books is by Sir John Pringle (1707–82), who was Physician-General to the Forces from 1742–48, and is entitled *Observations on the Diseases of the Army* (London, 1752). Pringle was an extraordinary man. In 1730 he graduated in medicine at Leyden. By 1734 he was joint Professor of Moral Philosophy at Edinburgh. In 1742 he was appointed physician to the Earl of Stair, who was commanding the British Army in the Low Countries. We will stop here a moment to quote from Pringle's medical account of the campaign his observation on the Influenza in the year 1743. He defines it as "a short fever attended with a violent catarrh." Huxham, as we have seen, was taking note of it in England at the same time, but Huxham's book was published two years before Pringle's. This is what the Physician-General says: "Soon after, the *Influenza* passing through a great part of Europe, was sensibly felt at Brussels, though but little in the cantonments, excepting so far, as many, who in the preceding autumn had been seized with intermittents, then relapsed."

Three years later Pringle was with the Duke of Cumberland in the campaign of the '45. When he arrives at Litchfield we have an opportunity of observing, in a brutal age, the uniformity and persistence of practical good works in one of the Christian communities: "The Quakers had made a present of flannel under-waistcoats to the soldiers, which was a seasonable pro-

vision for a winter-campaign." About this time Pringle was elected a Fellow of the Royal Society. He was again, till the Peace of 1748, with the army on the continent.

In 1750 the Royal Society awarded him the Copley medal, and we are startled when we encounter the modern word "antiseptic" in the title of the researches for which he was awarded it: "Experiments upon Septic and Antiseptic Substances, with Remarks Relating to their Use in the Theory of Medicine." The earliest use of the word "antiseptic" recorded in the Oxford English Dictionary is in the *Gentleman's Magazine* for 1751. In 1752 Pringle married the daughter of that Dr. Oliver, of Bath, after whom a certain famous biscuit is named, and in the same year published his classic work on the Diseases of the Army. In 1772 he was elected President of the Royal Society. Captain Cook was his friend.

"In early life, his religious opinions seem to have been fluctuating, but he diligently investigated the subject in his maturer days, and became an earnest reader of commentators on the Scriptures, and of sermons." He did not derive much pleasure from poetry, but was a lover of music. In the year 1782, while dining with a small club in the Strand, he was seized with a fit, and died a few days later.

Some such staccato account as the above will serve to show to what kind of men in the eighteenth century, sturdy individualists, we owe the pioneer work of founding, or rather of creating, hygiene in the British Army. Pringle's military career must have been one long fight for principles which he imprinted once and for all on the military medical service. He was a Scotsman, but probably the Scots reader will have guessed.

Typhus, or jail fever, or hospital fever, which Pringle recognizes as the same disease, was the rampant enemy. If we may quote a few sentences from Sir Arthur Newsholme (*Evolution of Preventive Medicine*) we shall see what a great part men like Pringle, by their wise and clear-sighted reforms, although in a sense they were fighting in the dark, played towards its extermination. It is only in almost recent times that typhus has been stamped out, but Pringle and his compeers were on the right track: "We now know that it is spread by lice which pass directly from the sick to the healthy, or by bedding, clothes, or garments which have been in contact with infected persons; and that although overcrowding and dirt greatly increase the risk of infection, they do so by favouring infestation

by lice; and it is not the least romantic aspect of the disappearance of typhus fever that, in Western civilized countries this disease became practically extinct before it was ascertained that the louse was responsible for spreading it. No more eloquent testimony to the value of personal cleanliness, irrespective of disease, could be adduced."

From a book in which the author seems to forget nothing tending to the good of the soldier, it is difficult to select one passage which shall best show how far Pringle had advanced towards modern ideals of hygiene, but the following will strike a new note, and correlate Pringle with Stephen Hales, of whom we have already spoken:

> As to the disposition of hospitals, with regard to preserving the purity of the air, the best rule is, to admit so few patients into each ward, that to those unacquainted with the danger of bad air, there may appear room to take in double or triple the number. It will also be found a good expedient, when the cielings are low, to remove some part of them, and to open the garret-story to the tiles. Constant experience evinces, that in a few days the air will be corrupted in close and crouded wards; and what makes it hard to remedy the evil, is the difficulty of convincing either the nurses, or the sick themselves, of the necessity of opening the doors or windows at any time for air. I have generally found those rooms the most healthful, where, by broken windows and other defects, the air could not be excluded.
>
> It is therefore probable, that when fire-places are wanting, a preservative would be found in the use of the ventilators of my late worthy friend, the reverend Dr. Hales, of which some might be made for the hospitals small enough to be easily carried about. By such an invention we might hope for a considerable purification of the air in every ward; and the working them might be a good exercise for the convalescents.

Any account of Pringle, however brief, would be incomplete without his description of the germ of the doctrine that War Hospitals shall be immune from gunfire. It is probable that the idea was Pringle's as much as his illustrious patron's. In the following passage we have the beginning of the Red Cross movement:

> Among the chief causes of sickness and mortality in an army, the reader will little expect that I should rank the hospitals themselves, though intended for its health and preservation, and that on account of the bad air and other inconveniences attending them. During the former war, one considerable step was made towards their improvement. Till then it had been usual for the security of the sick (when the enemy was near) to remove them

a great way from the camp; whereby many were actually lost before they came under the care of the physicians. But the Earl of Stair, my illustrious patron, being sensible of this evil, when the army was encampd at Aschaffenburg, proposed to the Duke de Noailles (of whose humanity he was well assured) that the hospitals on both sides should be considered as sanctuaries for the sick, and mutually protected. This was readily agreed to by the French General, who took the first opportunity to shew a proper regard to his engagement. For when after the battle of Dettingen, our hospital was at Feckenheim, a village upon the Maine, at a distance from the camp, the Duke de Noailles having occasion to send a detachment to another village, upon the opposite bank, and apprehending that this might alarm the sick, he sent to acquaint them, that, as he knew the British hospital was there, he had given express orders to his troops not to disturb them. This agreement was strictly observed on both sides during that campaign, and though it has since been neglected, yet it is still to be hoped, that on future occasions the contending parties will make it a precedent.

To pass from Pringle to James Lind (1716–94) is to pass from land to sea. He was Physician to the Royal Naval Hospital at Haslar from 1758 till 1783. Much the same heroic and enlightened principles are found in Lind. He has the same care for ventilation, cleanliness and diet, but with regard to diet he is of even greater interest for us to-day, for he had ideas which make him the fit subject of careful study by the modern student of the theory of vitamins.

Sir Humphry Rolleston in the first sentence of his memoir of Lind (*Journal of the Royal Naval Medical Service*, 1915) at once sets Lind as a foremost figure in the company of those who have contributed most to the welfare of mankind: "The abolition of scurvy in the Navy, in 1796, was a stroke of preventive medicine comparable in its sanitary and economic effects to the control of malaria about a century later, and was so complete that James Lind is now little more than a name."

The ravages of the scurvy on board ship, caused by the absence of vegetable diet on long voyages, were continually, up to Lind's time, almost paralysing naval activity. Lind, in the preface to his great book, *A Treatise of the Scurvy* (Edinburgh, 1753), observes that "the scurvy alone, during the last war, proved a more destructive enemy, and cut off more valuable lives than the united efforts of the French and Spanish arms." Sir Peter Hawkins, writing one hundred and fifty years earlier, "in his observations made in a voyage to the South sea, remarked it to be the pestilence of that element."

Huxham in 1747, writes from Plymouth to the *General Evening Post*, when Admiral Martin's fleet returned after a voyage of only thirteen weeks, with one thousand two hundred men incapacitated with scurvy, and recommends vegetable diet. On Lord Anson's voyage round the world (1740) seventy-five per cent. of the crew died. Lind himself, in a ten-weeks' voyage in H.M.S. *Salisbury*, had seen eighty out of three hundred and fifty sailors attacked by the malady.

It was Lind who recommended the use of lemon juice. The specific was not his discovery, as it had been fitfully spoken of by earlier writers, but it is to Lind that sole credit is due for its revival. He describes in his book an experiment which he himself made in 1747 on the *Salisbury* on twelve scurvy patients, whose cases were as similar as he could have them. Two were put on oranges and lemons, the others on different treatments. The effect on the two was magical:

> The consequence was, that the most sudden and visible good effects were perceived from the use of the oranges and lemons; one of those who had taken them, being at the end of six days fit for duty. The spots were not indeed at that time quite off his body, nor his gums sound; but without any other medicine, than a gargarism of *elixir vitriol*, he became quite healthy before we came into *Plymouth*, which was on the 16th of June. The other was the best recovered of any in his condition; and being now deemed pretty well, was appointed nurse to the rest of the sick.

Alas, Lind's recommendations were not adopted at the time of the publication of his book (1753), and it was not till 1795, in the year following Lind's death, that by the efforts of Sir Gilbert Blane, who was Commissioner of the Board of the Care of Sick and Wounded Seamen, the Admiralty issued an order for the use of lemon juice in the Navy. The scurvy immediately disappeared.

Lind published also *An Essay on Diseases Incidental to Europeans in Hot Climates* (1768), and this book is one of many published in the eighteenth century which form the nucleus and were the inspiration of the now vast literature of Tropical Medicine.

We have taken only a few names to illustrate the extraordinary reaction during the eighteenth century to new conditions of life. These names alone bear witness to that innate urging in man to help his brother and to alleviate the lot of the unfortunate and the stricken. We sometimes think of the eighteenth century, despite its culture and urbanity, as a brutal time in

many of its aspects. But if we enquire, and especially look into the medical literature of that period, we shall find ourselves wondering whether if the seventeenth century was the age of curiosity and its satisfaction, was not the eighteenth the age, shall we say it, of philanthropy? At least, that hundred years saw the most extraordinary stirrings of conscience.

CHAPTER XVII

EIGHTEENTH CENTURY INFLUENCES ON MODERN MEDICINE

THE MEDICAL literature of the eighteenth century is of such enormous extent that at the commencement of a short chapter on what it stands for one may well pause hesitant. All Europe had become rather tediously civilized. Many delightful idiosyncratic things had disappeared, and many rather dull and formal things had taken their place. But the progress of medical science continued, only the tempo was altered, and we have to adjust our minds to a new rhythm.

Our only means of judging the progress of medicine is by reference to the medical literature of the period, and here it must be acknowledged that activity became universal. If we gain admittance to one of the great medical libraries, we shall first of all be bewildered by the endlcss number of medical books printed in the eighteenth century, and then, if we enquire a little more closely, we shall arrive at the conclusion that everyone in those days who did not publish a book at least published a pamphlet. There are thousands and thousands of them. In this golden age of urbanity the medical literature of attack and defence and of brotherly vituperation alone would furnish materials of study for a not particularly profitably spent life.

What did all this activity mean? How much of it was theory, and how much of it was progress? It is only possible here to dwell for a few pages on the progress, and for that purpose a few names must be chosen, and many famous names omitted. If not much is said about the world-renowned Dr. Mead, it is because an Italian named Morgagni or an Austrian named Auenbrugger or an English provincial physician named Withering is more scientifically important.

At the beginning of the century stands the figure of Hermann Boerhaave (1668–1738), a beautiful and gentle and wise soul, who was Professor of the Institutes of Medicine (approximating to what we now call physiology), of Practical Medicine, and of Chemistry, at Leyden. For over twenty years it was

Boerhaave who *was* European Medicine. He was one of the greatest teachers which medicine has ever had, and it was by his influence, and not by his original work (except perhaps in the department of chemistry) that he became immortal. Pupils flocked to Leyden from every country of Europe, and from beyond seas. The walls of the city, it is said, had to be extended to receive them, and a letter addressed to *Boerhaave, Europe*, from far China, would reach its destination. Boerhaave has lived on in the great teachers and physicians which he made of his pupils. The judgements on Boerhaave in modern histories of medicine are amusingly diverse, but all agree that by his bedside and his post-mortem teaching he fashioned the course of medicine. Especially must it be recorded that one of his pupils, Alexander Monro (1697–1767), went back to Edinburgh, where, at the age of twenty-four, he was appointed Professor of Anatomy in 1721. From that moment Edinburgh steadily rose to be among the greatest of medical schools, and it is not too much to say that through Monro and some of his contemporaries, we may trace the profound and beneficent influence of Boerhaave down to the great days of the sixties of last century, when in 1869, with Lister's appointment as Professor of Surgery, Edinburgh reached its highest point as one of the greatest medical teaching centres the world had known.

Another of Boerhaave's pupils, Gerhard van Swieten (1700–72) moulded what is known as the Old Vienna School of Medicine to be a great instrument of medical activity.

When Boerhaave died in 1731, John Huxham, who had been one of his pupils, writing in remote Devonshire, makes this note among his daily observations on the air; "But alas! I just now hear that immortal man is gone to the gods, *quem Saecula nulla tacebunt*": about whom no ages to come shall be silent.

We must pause for a moment to note that in the hands of Albrecht von Haller (1708–77), the greatest of Boerhaave's pupils, physiology acquired at length a master who in the vast sweep of his intellectual range was worthy of it. Haller's great work, the *Elementa Physiologiae Corporis Humanae* (8 vols., 1759–66), is the portal through which physiology passes from the older spasmodic efforts and researches to a complete system instinct with the modern spirit.

During the eighteenth century there was a curious lull in microscopic research. Both bacteriology, and the key to biology, the cell theory, were to sleep till the nineteenth century called

them to a full dawn. Meanwhile, there was a rather arid period of attempts to systematize medicine, over which it would be useless to pause. As we have seen, men were beginning to turn their attention to questions of practical hygiene. But on the whole the Faculty just now were excessively good at Latin periods, and addressed one another with many an *Illustrissime Vir*. Some good work, however, was being done on the lines of Sydenham, and in 1748 we may greet as a sign of better things a book by a good Quaker physician, John Fothergill (1712–80): *An Account of the Sore Throat Attended with Ulcers; A Disease which hath of late Years appeared in This City and the Parts Adjacent.* This is what we now know as diphtheria (but it was not so called till 1826, when it was given that name by Pierre Bretonneau, a great French physician). Here is Fothergill's short description of the disease. How it echoes the style of Sydenham, yet shows a more modern view.

It seems not unreasonable to suppose—

> That the Cause of this Disposition or Tendency is a putrid *Virus*, or *miasma sui generis*, introduced into the Habit by Contagion, principally by means of the Breath of the Person, from whom it is received;
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> That this *Virus*, or contagious Matter, produces Effects more or less pernicious, according to the Quantity and Nature of the Infection, and as the Subject is disposed to receive or suffer by it;
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> That putrefactive and malignant Diseases, in common, admit of the most sensible and secure Relief, from Discharges of the peccant Matter, either upon the Skin in general, or on particular Parts of the Body;
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> That the Redness, and cutaneous Efflorescence in the present Case may be consider'd as an Eruption of the like Nature; and therefore to be promoted by such Methods as have proved successful in similar Diseases;
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> That a cordial, alexipharmic, warm Regimen has been found by Experience to be of most Use in such Cases; and that Bleeding, Purging, Antiphlogistics, liberally employed, either retard, or wholly prevent these Discharges.

At this point we will mention a man whom all the men of his time praised, and whose book all physicians have praised since. The man is William Heberden (1710–1801), and his book is *Commentaries on the History and Cure of Diseases*, which was published, both in Latin and English, in 1802, the year following his death. This great physician and impeccable scholar has been called *Medicus vere Hippocraticus*: a physician truly of the race of Hippocrates; and Dr. Johnson, whose physician he was, called him "Ultimus Romanorum, the last of our great

physicians". His book consists of short chapters, each on some particular disease, and it contains more original and classic observations than any medical book of its century. If the layman turns to the last page he will find there a passage which will very well sum up for him what he supposes to be the whole striving of modern biology and modern science. But one hardly expects this in the eighteenth century:

> Whoever applies himself to the study of nature, must own we are yet greatly in the dark in regard even to brute matter, and that we know but little of the properties and powers of the inanimate creation; but we have all this darkness to perplex us in studying animated nature, and a great deal more arising from the unknown peculiarities of life: for to living bodies belong many additional powers, the operations of which can never be accounted for by the laws of lifeless matter. The art of healing therefore has scarcely hitherto had any guide but the slow one of experience, and has yet made no illustrious advances by the help of reason; nor will it probably make any, till Providence think fit to bless mankind by sending into the world some superior genius capable of contemplating the animated world with the sagacity shewn by Newton in the inanimate, and of discovering that great principle of life, upon which its existence depends, and by which all its functions are governed and directed.

The first half of the eighteenth century had, as if exhausted by the extraordinary period of research in the seventeenth century, been content to specialize in theories of medicine, and to forget that there still existed the actual mysterious body of man, as illimitable in its possibilities for exploration as the stars of Newton. Bonetus, whom we mentioned at the end of the last chapter of the seventeenth century, had been on the right track, but his marshalling of the facts about the dead body had been uncritical, and, as Dr. Esmond R. Long (*A History of Pathology*, 1928) says: "The great trouble with it is its utter lack of organized deduction". It was well enough to collect all the existing records of post-mortems, but what was wanted was to correlate the knowledge gained from the dead body with the living disease.

This gigantic task was achieved by an Italian physician, Giovanni Battista Morgagni (1682–1771), and it was Morgagni who saved the eighteenth century by creating the science of modern pathology. Given an apparatus of morbid anatomy, medicine could proceed to the experimental investigation of disease, and get far beyond the stage of clinical observation with which the first half of the century was largely occupied.

Morgagni published his great book at Venice in 1761, and it

was called *De Sedibus et Causis Morborum per Anatomen Indagatis* and if we translate that title literally we shall see exactly what the book was: "Concerning the Seats and Causes of Diseases, Tracked down by Anatomy." He means, of course, necropsy, or examination of the dead body. It had not been attempted on this scale by a master mind before. Let us again quote Dr. Esmond R. Long:

> The feature of the work leading to immediate obsolescence of all preceding dissertations on pathological anatomy, was its extraordinary completeness of correlation between clinical detail and post-mortem revelation. Pages, not lines, as heretofore, were devoted to the history of the patient's ailment, and the results of the necropsy are recorded at exhaustive length, leisurely, with no apparent fear of taxing the reader's patience. Copious references indicate the author's enormous reading on his subject.

It need not be supposed that the work of Morgagni (like the work of Harvey) had immediate and universal effect on the world of medical practice. Sir Clifford Allbutt, writing of William Cullen (1712–90), who was Professor of Medicine, first at Glasgow, and then at Edinburgh, and was certainly one of the greatest medical figures of his time, says:

> If Haller was thus neglected, what of the equally great Morgagni, whose celebrated letters on the seats and causes of disease were published in 1761, twenty years before Cullen's *Practice of Physic* appeared? An eminent writer says that Morgagni's great work "made pathological anatomy a science, and diverted the course of medicine into new channels." Would that it had! Again, the reader may peruse Cullen from cover to cover and fail to find out that Morgagni had ever existed. As Haller had to wait for Bernard, so Morgagni had to wait for Laennec and Bright; disciples worthy also in this that, like their great forerunner, they never forgot that, for the physician at any rate, pathology can be studied profitably only in connection with clinical medicine; and thus in them it was preserved from the scholasticism of the great Rokitansky. Even Matthew Baillie can hardly be acquitted of some forgetfulness of this truth—that only in the combination of the two points of view—the clinical and pathological—can medicine find its safety.

There were, however, other forces at work which were to quicken the eighteenth century into a great and memorable period. The brothers William and John Hunter came down from Scotland, and by their Herculean labours set their stamp for ever on the course of medical research. It is very difficult to express in a few lines what these marvellous brothers did do.

William Hunter (1718–83), after residing for three years with William Cullen, who was then a surgeon in the village of Hamilton, in Scotland, and spending the best part of a year in Edinburgh, where he studied anatomy under the great Alexander Monro, came to London, in the year 1740. He was an obstetrician and a physician, but he was also the prime force in anatomical instruction of his age. He delivered lectures on anatomy and dissection as such lectures had never been delivered before. The Theatre of Anatomy which he built in Great Windmill Street, with its museum and vast collection of specimens, transformed anatomical instruction in this country from a series of sporadic individual semi-commercial efforts to a noble and unified foundation which was the cradle of practically the whole of British anatomical anthropological research. This has been shown by nobody so completely as by Dr. G. C. Peachey, who, in his *Memoir of William and John Hunter* (1924), first traced, as it had never been done before, with meticulous care and accuracy, the history of anatomical instruction in England, and then with the most exact accumulation of data, showed the revolution which William Hunter created in founding a school that was to be world-wide in its influence.

John Hunter came to London in 1748, eight years after his brother, and became his pupil. Later the brothers parted, and John gave independently lectures on surgery and anatomy. It may be said of John Hunter that he took the whole range of nature and of animal life for his study, and that by comparative studies of its manifestations in every department, on a scale that had never been attempted before, he was able to foreshadow in himself the modern concepts of physiology, biology, and pathology. There is to-day no laboratory in these branches of science that does not owe its direct debt to John Hunter. He too, like his brother William, formed a museum of specimens, and the collections of both brothers were unparalleled, but the collection of the elder brother, who cared for scholarship in a way that John did not, extended to books and art, as well as anatomy. This collection is now at Glasgow, and the collection of John Hunter is at the Royal College of Surgeons, London.

John Hunter was also surgeon to St. George's Hospital, and with him surgery began to be practised not as an empirical necessity so much as a branch of pathology and physiology. He himself was one of the modern martyrs of science, for he inoculated himself with lues venerea, the cure of which took three years.

The literature that has grown around the Hunters is enormous, but for the facts, the multitudinous and accurate facts, which show forth the tireless activity, the dynamic energy, the coherency of purpose, of these two men, students and posterity will have to go always to Dr. Peachey's book. We may well, therefore, conclude with his words:

> Looking back upon the perspective of the past, one can see in fancy—far away in the distance—the figures of two great Scotsmen, conspicuous, like giants, upon the skyline of medical history. They are the figures of William and John Hunter; of William, the founder of the Windmill Street School of Anatomy, and of John, the greatest pathologist the world had seen.

The cause of pathology was next firmly founded in this country (as it had been almost created on the continent by Morgagni) by Matthew Baillie (1761–1823), the nephew of the Hunters. He had been pupil and assistant to, and was the heir of, William Hunter, and had probably had a greater opportunity than any man in England to make post-mortem examinations, and to observe morbid change. In 1793 he published *The Morbid Anatomy of Some of the Most Important Parts of the Human Body*. It was the first book of its kind in England. In contrast to Morgagni's large folio of closely-printed pages, Baillie's book is a convenient octavo of 314 pages of fair-sized print, and it is arranged under the various organs and not under diseases. It was, therefore, designed in every way for use and immediate appeal. If we read the following two paragraphs, we shall be present at the inception of a newly organized science, and we shall catch some of the novelty of a situation which has now become a commonplace:

> It is very much to be regretted that the knowledge of morbid structure does not lead with certainty to the knowledge of morbid actions; yet surely it lays the most solid foundation for promoting such inquiries with success. In proportion, therefore, as we shall become acquainted with the changes produced in the structure of parts from diseased actions, we shall be more likely to make good progress towards a knowledge of the actions themselves, although it must be very slowly. The subject in itself is extremely difficult, because morbid actions are going on in the minute parts of an animal body excluded from observation; but still the examination of morbid structure seems to be one of the most probable means of throwing light upon it.
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> A person who previously had attended very accurately to symptoms, but was unacquainted with the disease, when he comes to examine the body after death, and finds some of the appear-

> ances that are described in this Treatise, will acquire a knowledge of the whole disease. He will be able to guide himself on such knowledge in similar cases, and also to inform others. It may, perhaps, too lead him to a proper method of treatment.

But there was still lacking a more profound understanding of the human body in its relation to disease than was known to Morgagni, and it is this fresh concept that places the work of Marie François Xavier Bichat (1771–1802) as the bridge between Morgagni, Baillie, and the modern cell theory, which was later on to be developed first by Schwann and Schleiden and finally by Virchow. Bichat died at the age of 31, but before he left this world the young Frenchman had come to view the human body in a new way. He moved from anatomy to structure, and came to see, to quote Dr. J. F. Fulton (*Physiology*, New York, 1931) "that the living body is an expression of the combined and adjusted lives of its constituent tissues. This led almost at once to a more exact experimental analysis of living phenomena. He had approached anatomy and physiology in the modern spirit, and prepared pathology for the cellular theory through his insistence that morbid processes occurred in small and discreet units of tissues rather than in organs as a whole." Bichat, as much as Malpighi, is the founder of modern histology.

Gradually, even in so brief a review as this, we see the gaps being filled, and the solid basis being constructed on which was to be built the astounding edifice of nineteenth century medicine. We must now refer to two great instruments or methods of diagnosis without which many of the advances we have recorded would have been labour in vain. Before doing so, however, we should like to remember that an English physician, Sir John Floyer (1649–1734), of Lichfield, published in 1707–10 *The Physician's Pulse Watch: or an Essay to Explain the Old Art of Feeling the Pulse, and to Improve it by the Help of a Pulse Watch.* Floyer's Pulse Watch divided the minute, for this was before watches had hands to record the seconds. His methods were not adopted or adapted till more modern times, but the old physician of Lichfield may be thought of as the precursor of that kindly figure, watch in hand, which so often puzzled the questioning mind of our childhood. What would he say to us when he took his hand away?

We now come to two of the most profound gifts to the healing art.

In the year 1761 there was published at Vienna a slim book of ninety-five pages, little more than a pamphlet, called *Inventum*

Novum ex Percussione Thoracis Humani ut Signo Abstrusos Interni Pectoris Morbos Detegendi. This was the work of Leopold Auenbrugger (1722–1809), a simple-minded, beneficent, unassuming physician of Vienna. He was ever at the beck and call of his patients, in his leisure hours cultivated music, and had even written the libretto of an opera called "The Chimney Sweep." A few words quoted from the brief preface to his *Inventum Novum* will show what he now presented to the world:

> I here present the Reader with a new sign which I have discovered for detecting diseases of the chest. This consists in the Percussion of the human thorax, whereby, according to the character of the particular sounds thence elicited, an opinion is formed of the internal state of that cavity. In making public my discoveries respecting this matter, I have been actuated neither by an itch for writing, nor a fondness for speculation, but by the desire of submitting to my brethren the fruits of seven years' observation and reflexion. In doing so, I have not been unconscious of the dangers I must encounter; since it has always been the fate of those who have illustrated or improved the arts and sciences by their discoveries, to be beset by envy, malice, hatred, detraction, and calumny.
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> This, the common lot, I have chosen to undergo; but with the determination of refusing to every one who is actuated by such motives as these, all explanation of my doctrines. What I have written I have proved again and again, by the testimony of my own senses, and amid laborious and tedious exertions; still guarding, on all occasions, against the seductive influence of self-love. —(*Forbes's Translation*, 1824.)

He begins his book: "The thorax of a healthy person sounds, when struck . . . The sound thus elicited from the healthy chest, resembles the stifled sound of a drum covered with a thick woollen cloth or other envelope." And he begins his directions: "The thorax ought to be struck, slowly and gently, with the points of the fingers, brought close together and at the same time extended." "During percussion the shirt is to be drawn tight over the chest, or the hand of the operator covered with a glove made of unpolished leather."

But Auenbrugger hardly even encountered the opposition which he expected, for his great discovery was ignored by the academic mind. His master, Van Swieten, who had been a pupil of Boerhaave, and was now at the head of the Vienna Medical School, cared nothing for it. The whole matter was forgotten till Jean Nicolas Corvisart (1755–1821), Napoleon's

physician, revived and translated the book in 1808, a year before Auenbrugger's death. From that time Auenbrugger's name has been counted among those of the great benefactors of medicine.

Although Corvisart, with his great name and position, rightly is accorded the honour of giving Auenbrugger his due, it may be mentioned that a physician named Rozière de la Chassagne published a little book, called *Manuel des Pulmoniques*, at Paris in the year 1770, and that at the end of it he printed a French translation of Auenbrugger's work.

An even greater discovery was to come. The story of Réné Théophile Hyacinthe Laennec (1781–1826) is one of the most touching and most heroic in the whole history of science. It has been beautifully told for English readers by Sir William Hale-White (*Laennec: Translation of Selected Passages from De l'Auscultation Médiate*. With a Biography by Sir William Hale-White. London, 1923), and to this delicate piece of interpretation we refer our readers. There we can read of Laennec's struggle with disease and poverty (he died of consumption), and of all the superhuman work that he achieved.

Laennec was the discoverer of the stethoscope. He was never in England, but he has probably been met in Sussex by every reader of these pages in Mr. Kipling's story of the "Marlake Witches" in *Rewards and Fairies*. The following passage, which we take from Sir William Hale-White's translation, will tell us, in Laennec's own words how he came to make his discovery:

> In 1816 I was consulted by a young woman presenting general symptoms of disease of the heart. Owing to her stoutness little information could be gathered by application of the hand and percussion. The patient's age and sex did not permit me to resort to the kind of examination I have just described (i.e., direct application of the ear to the chest). I recalled a well-known acoustic phenomenon: namely, if you place your ear against one end of a wooden beam the scratch of a pin at the other extremity is most distinctly audible. It occurred to me that this physical property might serve a useful purpose in the case with which I was then dealing. Taking a sheaf of paper I rolled it into a very tight roll, one end of which I placed over the præcordial region, whilst I put my ear to the other. I was both surprised and gratified at being able to hear the beating of the heart with much greater clearness and distinctness than I had ever done before by direct application of my ear.
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> I at once saw that this means might become a useful method for studying, not only the beating of the heart, but likewise all

movements capable of producing sound in the thoracic cavity, and that consequently it might serve for the investigation of respiration, the voice, râles and even possibly the movements of a liquid effused into the pleural cavity or pericardium.

With this conviction, I at once began and have continued to the present time, a series of observations at the Hôpital Necker. As a result I have obtained many new and certain signs, most of which are striking, easy of recognition, and calculated perhaps to render the diagnosis of nearly all complaints of the lungs, pleuræ and heart both more certain and more circumstantial, than the surgical diagnosis obtained by use of the sound or by introduction of the finger.

Here is Sir William Osler's tribute to Laennec, his book, and his discovery:

Before Laennec, the examination of a patient had been largely by sense of sight, supplemented by that of touch, as in estimating the degree of fever, or the character of the pulse. Auenbrugger's " Inventum Novum " of percussion, recognized by Corvisart, extended the field; the discovery of auscultation by Laennec, and the publication of his work,—" *De l'Auscultation Médiate*, 1819,—marked an era in the study of medicine. The clinical recognition of individual diseases had made really very little progress; with the stethoscope begins the day of physical diagnosis. The clinical pathology of the heart, lungs and abdomen was revolutionized. Laennec's book is in the category of the eight or ten greatest contributions to the science of medicine.—(*The Evolution of Modern Medicine*, 1921.)

The eighteenth century is approaching its end. One of the marvels of that century is that amid all the wars and upheavals science went its unremembering way and achieved so much. In this brief survey of the progress of medicine, we can but refer to the triumphs, towards the end of the century, of the great chemists. Lavoisier, Joseph Black, Cavendish and Priestley had carried on the work of Boyle, and that work is often hardly to be differentiated from the progress of medicine.

Let us, before leaving this period, look back once more to the rise of pathology (with its study of morbid structure) and to the development of the idea of hygiene, to assure ourselves that in these two directions the eighteenth century was not merely a temple of philosophy, but possessed itself of treasure illimitable for the practical service of mankind.

It would be wrong also to leave this century without noting a most important and hopeful thing, the tendency here and there towards specialization in the diseases and hygiene of

children. George Armstrong (d. 1781) had published in 1767 his little book *An Essay on the Diseases Most Fatal to Infants*, and Michael Underwood (1737–1820) followed in 1789 with *A Treatise on the Diseases of Children*, which met with great popularity. In Sweden, Nils Rosén von Rosenstein (1706–73) published a similar book in 1771, and this was translated into English.

There is one other book which must be mentioned, because it is now so famous and so rare, that it will be looked for by the critical, and especially the American, reader. This book stands at the head of all modern research in drug therapy. It is *An Account of the Fox-Glove, and Some of its Medical Uses*, and was published in 1785. Its author was William Withering, a physician of Birmingham. The book is an account of a long series of experiments in the effect of digitalis on the heart, and as a remedy in dropsy, and is one of the dozen great and outstanding classics in English medical literature.

CHAPTER XVIII

INOCULATION AND VACCINATION LEADING TO IMMUNIZATION

WE HAVE now to go back to the beginning of the eighteenth century to note a light rising from the East, but having its actual kindling one hardly knows where, in the dim regions of antiquity, but which was to prove one of the brightest beacons in the train of health. We hear a great deal to-day about immunization, and vaccines, and inoculation, but probably few people stay to realize that the theory of having a disease slightly and deliberately, so that one shall not have it worse, is very ancient. The cruel scourge of the small-pox has been one of the most formidable enemies of the human race, and it is curious that this disease should have provided unlettered tribes with, if not a remedy, at least a defence, which in modern times has afforded a clue to some of the most beneficent triumphs of preventive medicine.

Dr. Arnold Klebs (*The Historic Evolution of Variolation;* Johns Hopkins Hospital Bulletin, 1913) has traced with fine scholarship the history of inoculation for the small-pox, which he conveniently calls variolation (Lat. *variola*, small-pox). He cites a very curious verse of the School of Salerno, which certainly refers to this practice, and of this we give his translation:

> In order that variola may not produce death among tender babes, put into their veins a favourable variola. Better still they should avoid touching the contagium of the disease: the sick person, the breath of the sick, the clothes, the coverings, the garments and such clean bodies as he may have infected (*tetigit male*) with his hand.

If now further we quote the following two paragraphs from Dr. Klebs's account, we shall be provided with sufficient comparative and historical evidence to satisfy ourselves that inoculation is no new thing:

> The earliest traces of variolation are found in Asia and in Africa. In Africa the practice continues to this day among certain tribes, chiefly negroes, in the eastern, central and western regions. On

the White Nile in the equatorial province (Welson and Felkin) among the Bari, and further east among the Somali (Stahlmann) a similar custom is found. It seems to have been highly developed by the most important of the native Bantu tribes, the Baganda, living north-west of Lake Victoria in the old kingdom of Uganda. Further west we find the Wanjamwesi, and in the Sudan, the Ashanti, and some Moorish tribes practice inoculation on their children. From northern Africa we have the report of the Tripolitan Ambassador, Kassem Aga, which made the round of eighteenth century literature, about the ancient variolation by Mohammedan tribes in Tripolis, Tunis and the Kabyl mountains. Not long ago we had a verification of this latter report by a French naval physician, Dr. H. Gros, stationed at Rébéval in Algeria. He has observed a considerable number of variolations practised by the Arabs and Kabyles, and curiously enough comes to the conclusion that variolation ought to be resorted to if, for some reason or other, the supply of vaccine became exhausted. This account contains many interesting observations which corroborate most of the historical records of the eighteenth century.

Exceedingly interesting accounts about smallpox inoculations are available from Asia. I can only briefly refer to them. China, of course, again is said to have known variolation since remotest times. We have no reliable data as to the age and extent of the practice; we must be satisfied with the knowledge that a method of inoculating the virus into the skin or in the form of dry powder blown into the nostrils, has been known to exist before it reached Europe. In India, a similar method seems to have been carried out on a systematic plan by special delegates of the Brahmin caste in conjunction with a religious cult of the smallpox deity.

The first news of inoculation seems to have reached England in 1713, when a communication on the subject from a Dr. Emanuel Timoni, a Greek physician who was then in Constantinople, was read before the Royal Society. In 1716 Sir Hans Sloane, then President of the Royal Society, gives an account in the *Philosophical Transactions* of the practice of inoculation in Turkey, derived from a Dr. James Pylarini, who had published a dissertation on the subject at Venice the year before, and who had been approached for information.

We come now to the famous episode of Lady Mary Wortley-Montagu. She was the friend of Pope, and her lively letters from the East will continue to be read notwithstanding the fact that a modern writer of her own sex has dubbed her a "dreary rattle." Her husband, Edward Wortley-Montagu was British Ambassador at Constantinople, and on April 1, 1717, she writes home to her friend Sarah Chiswell:

A propôs of distempers, I am going to tell you a thing, that will make you wish yourself here. The *smallpox*, so fatal and so general

amongst us, is here entirely harmless, by the invention of *engrafting*, which is the term they give it. There is a set of old women, who make it their business to perform the operation, every autumn, in the month of September, when the great heat is abated. People send to one another to know if any of their family has a mind to have the smallpox; they make parties for this purpose, and when they are met (commonly fifteen or sixteen together) the old woman comes with a nut-shell full of the matter of the best sort of smallpox, and asks what veins you please to have open'd. She immediately rips open that, you offer to her, with a large needle (which gives you no more pain than a common scratch), and puts into the vein, as much matter as can lie upon the head of her needle, and after that, binds up the little wound with a hollow bit of shell, and in this manner opens four or five veins. The Grecians have commonly the superstition of opening one in the middle of the forehead, one in each arm, and one on the breast, to mark the sign of the cross; but this has a very ill effect, all these wounds leaving little scars, and is not done by those that are not superstitious, who chuse to have them in the legs, or that part of the arm that is concealed. The children or young patients play together all the rest of the day, and are in perfect health to the eighth. Then the fever begins to seize them, and they keep their beds two days, very seldom three. They have very rarely above twenty or thirty in their faces, which never mark, and in eight days' time they are as well as before their illness. Where they are wounded, there remains running sores during the distemper, which I don't doubt is a great relief to it. Every year thousands undergo this operation, and the French Ambassador says pleasantly, that they take the smallpox here by way of diversion, as they take the waters in other countries. There is no example of any one that has died in it, and you may believe I am well satisfied of the safety of this experiment, since I intend to try it on my dear little son.

I am patriot enough to take pains to bring this useful invention into fashion in England, and I should not fail to write to some of our Doctors very particularly about it, if I knew any one of them that I thought had virtue enough to destroy such a considerable branch of their revenue, for the good of mankind. But that distemper is too beneficial to them, not to expose to all their resentment, the hardy wight that should undertake to put an end to it. Perhaps, if I live to return, I may, however, have courage to war with them.

She did have her dear little son inoculated, and the operation was performed by Charles Maitland (1668–1748), a Scots physician, who was in Constantinople at the time. A most interesting account of this man has been written by Dr. J. M. Bulloch (*A Pioneer of Inoculation—Charles Maitland*, Aberdeen, 1930), and it is from this memoir, which considerably adds to our knowledge of the early days of inoculation, that the following extracts and particulars, as far as Maitland is concerned, are taken.

Maitland, after he had got back to England, published in 1722 a pamphlet giving an account of inoculation and his own experiences of it. He says:

> In the year 1717, when I had the honour to attend the English ambassador, Edward Wortley-Montagu, and his family at Constantinople, I had a fair opportunity fully to inform myself of what I had long heard, namely the famous practice of transplanting or raising the smallpox by inoculation.

This is from his account of the actual operation on Lady Mary's son:

> [His mother] sent for an old Greek woman, who had practised this way for a great many years. The good woman went to work [on one arm] so awkwardly by the shaking of her hand and put the child to so much torture with a blunt and rusty needle that I pitied the cries.

"Maitland himself," continues Dr. Bulloch, "tackled the child's other arm, and 'with so little pain' that the boy did 'not complain'."

Lady Mary, on her return to England, did all she could to get the practice of inoculation introduced into this country. She was entirely successful. The following pleasant words written about her by her contemporary, Dr. J. Kirkpatrick, in his excellent book *The Analysis of Inoculation* (Second Edition, London, 1761), shall be quoted in contrast to the unkind things which have recently been said about her by Miss Sitwell:

> And when that noble Lady's very pretty poetical Compositions may be overlooked, from the Fluctuation of Language, and thro' the Waste of Time, that excellent Sense, which prompted her to more than female Resolution, in Tenderness for her Offspring, and proved in its Consequences an Introduction to this most salutary Practice, shall do unfailing Honour to her Memory; and *England*, that is said to have been termed abroad the Paradise of Women, shall exult on this Occasion, with the justest Gratitude to one, *Dux Femina Facti*.

She persuaded the Prince and Princess of Wales to have their two children, Princess Amelia and Princess Caroline, inoculated, but before this was done the King insisted that six condemned prisoners in Newgate should be experimented on, and given their freedom in return. This was done, and it was Maitland who performed the operation before a distinguished

audience. Mead was present, and on the day before the experiment Maitland sent an invitation to Sir Hans Sloane:

> HONOURED SIR—This comes to give you notice that the operation of inoculating the smallpox on the prisoners in Newgate is performed tomorrow morning about nyne aclock; at which time your presence will be very acceptable.

Very useful information was obtained from this experiment on the lucky criminals. One of them, on whom the inoculation had no effect, was found to have had small-pox before. Another was sent up to Hertford, where just then there was an epidemic of small-pox, and he showed immunity from the contagion. It is interesting to note that one of them, a girl, was inoculated the Chinese way, by inhalation of the virus.

By this evidence the King was satisfied, and the royal children were inoculated by Amyand, the Serjeant Surgeon. Maitland was present. This was in 1722. In 1724 the King sent him to Hanover to inoculate Prince Frederick, afterwards Prince of Wales, and for this he was paid £1,000. We wish we had space to quote the three wonderful letters or bulletins sent home by Maitland to Sloane on this occasion, and discovered by Dr. Bulloch among the Sloane MSS. "Thank God, H.R.H. continues well, but has been troubled this night with heat and highings all over his body. . . . The pustules of the smallpox to the number of at least 500 hold out fresh and red, and j doubt not in a few days more will be plump'd up and full. . . . At noon he had his water gruel, and then a little plain light bread-pudding made after the English manner, which he eat with a good appetit; but was readily advised to forbear and leave off without satisfying it. . . . He begins to be sore in his skin by these plumping pustules, and this afternoon laid himself down abed sooner than usual to ease him without the least inclination to sleep, for he diverted the company in conversation in a pleasant manner till 10 aclock at night."

From this time inoculation was adopted in this country. We have lingered over these early episodes in its history, because they are of more use to the general reader than any attempt to enter into the raging and billowy pamphleteering storms which followed and lasted through the century. Even the clergy were aroused, and preached sermons for and against. There was always the danger of the inoculated patient infecting others, but on the whole they seem to have managed that danger

pretty well. It is surprising that so much good and no greater harm came of the rather loose procedures. Kirkpatrick, in his careful and scientific book, gives on one page a curious side-light of the Populace going "promiscuously from different distances to little Market Towns, where, without any medical Advice, and very little Consideration, they procure Inoculation from some Operator, too often as crude and thoughtless as themselves; congratulating each other after it over strong Liquor, and returning immediately to their ordinary Labour and Way of living."

This does show the horror and fear in which small-pox was held. It is difficult to arrive at statistics, but McVail (*Half a Century of Small-Pox and Vaccination*, 1919) accepts the estimate that about 1720 the mortality was 16 or 17 per cent.; that at the London Hospital for Small-Pox and Inoculation from 1746 to 1763 the mortality was 25.3 per cent.; and that at the same place the rate from about 1775 to 1799 was 32.5 per cent. This takes no account of the horrible effects of the disease on the survivors.

Towards the end of the eighteenth century Edward Jenner (1749–1823), a native of Gloucestershire, appeared on the scene, and by his discovery of the principle of vaccination not only put an end to a method of immunization which was on the whole uncertain, the seed of endless controversy, dangerous and not wholly satisfactory, but he opened the door to a safety of which the harrassed world never had dreamed. The story is one of the most frequently recounted in the history of science, but it may briefly be recalled here.

In Jenner's native county, Gloucestershire, there was a popular notion that the dairymaids, after catching from the cows they milked a complaint known as cow-pox, were themselves afterwards immune from small-pox. That this was both well-known and contained truth is evidenced by the fact that one Benjamin Jesty (1737–1816), a farmer of Downhay, Purbeck, had in 1774, during an epidemic of the small-pox, inoculated his wife, his sons, and others, with vaccine from the cows. But this in no way takes the glory from Jenner, who over a long space of years, and by constant thought and experiment, used the tradition of his native county, on which to found a scientifically proved principle of treatment.

One day during Jenner's medical apprenticeship at Sodbury (this was before he went to London to be a pupil of John Hunter), a young woman came for advice, and the small-pox

PLATE LVII

TITLE-PAGE OF THE FIRST EDITION OF JENNER'S BOOK ON VACCINATION

The First Edition of Jenner's thin quarto came out in June, 1798, and it is evidence of the longevity of English publishing houses that the name at the foot of Jenner's title-page is the same as that on the title-page of the present book. There was also an issue by another firm. During this year Jenner came up to London to forward his discovery, but could get no one to be vaccinated, but a little later Henry Cline, Surgeon to St. Thomas's Hospital, vaccinated some patients with lymph given to him by Jenner. Jenner himself had better luck in 1800, when in February of that year, at the invitation of Lord Egremont, the great patron of the arts, he went down to stay at Petworth, for there he vaccinated nearly two hundred people with success: a considerable tribute to the English feudal system. In the same year he published the second edition of his book, and the third in 1801.

AN

INQUIRY

INTO

THE CAUSES AND EFFECTS

OF

THE VARIOLÆ VACCINÆ,

A DISEASE

DISCOVERED IN SOME OF THE WESTERN COUNTIES OF ENGLAND,

PARTICULARLY

GLOUCESTERSHIRE,

AND KNOWN BY THE NAME OF

THE COW POX.

BY EDWARD JENNER, M.D. F.R.S. &c.

——— QUID NOBIS CERTIUS IPSIS
SENSIBUS ESSE POTEST, QUO VERA AC FALSA NOTEMUS.

LUCRETIUS.

London:

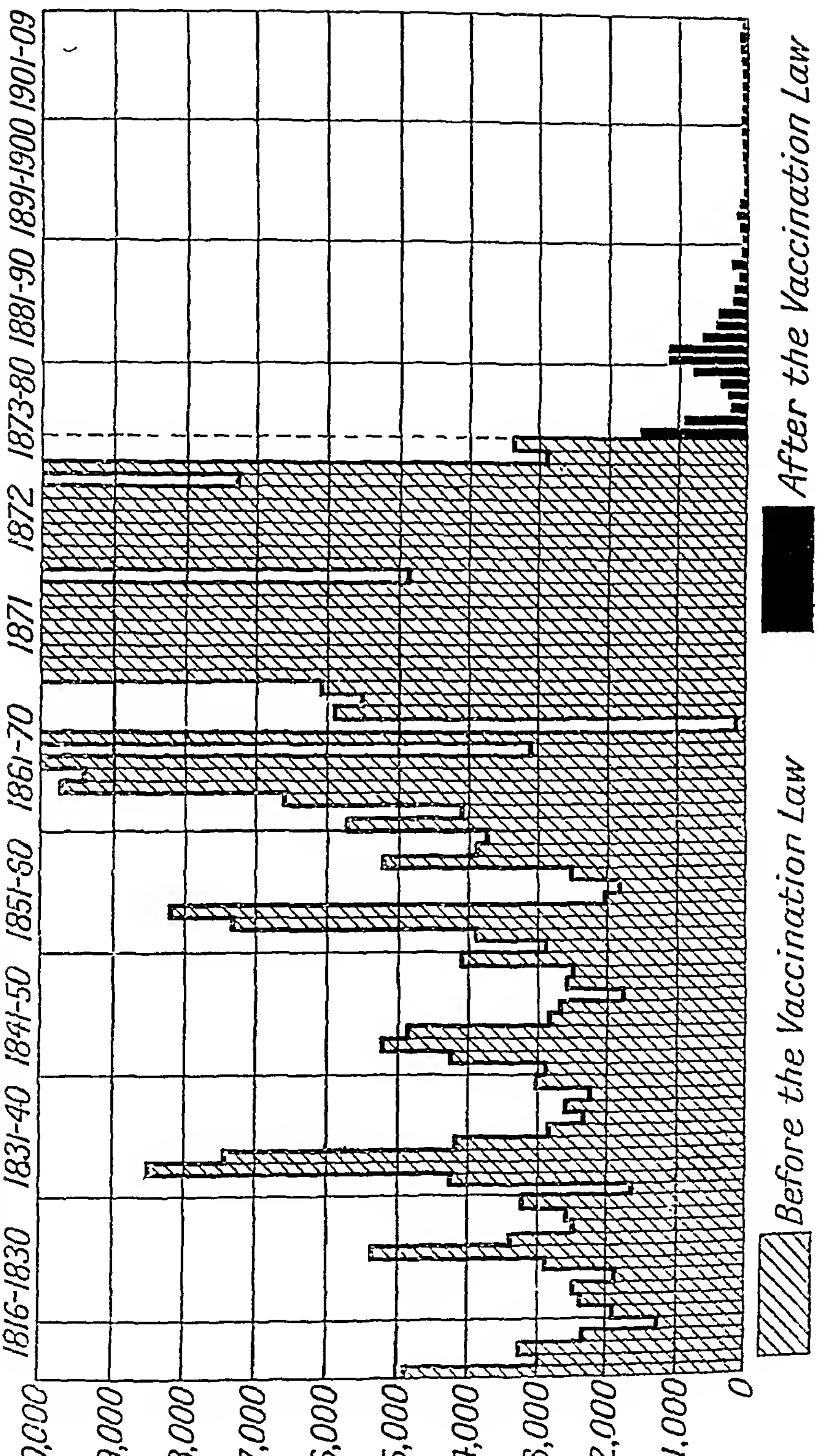
PRINTED, FOR THE AUTHOR,

BY SAMPSON LOW, Nº. 7, BERWICK STREET, SOHO:

AND SOLD BY LAW, AVE-MARIA LANE; AND MURRAY AND HIGHLEY, FLEET STREET.

1798

PLATE LVIII



1816-1830
1831-40
1841-50
1851-60
1861-70
1871
1872
1873-80
1881-90
1891-1900
1901-09
10,000
9,000
8,000
7,000
6,000
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4,000
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2,000
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Before the Vaccination Law
After the Vaccination Law

PLATE LVIII

STATISTICAL PROOF OF EFFICACY OF SMALL-POX VACCINATION

The chart shows small-pox mortality during a period of a century in Germany. Vaccination was made compulsory in April, 1875, and in that year the total deaths from small-pox dropped to about fifteen hundred compared with totals exceeding ten thousand in each of the years 1871 and 1872. Thereafter the deaths fell nearly to zero.

After Jockmann, "Pocken and Vaccinationlehre", 1913.

being mentioned she said, "I cannot take that disease, for I have had cow-pox." This remark took seed in Jenner's mind.

Young as Jenner was, he did not forget this hint of a possible prophylaxis. "He was the more stimulated to meditations of this sort," says his biographer John Baron, "by frequent opportunities of witnessing the ravages of small-pox; and by retaining the most vivid and painful recollections of the severe discipline which he himself had not long before passed through, preparatory to his inoculation for that disease. 'There was,' to use his own words, 'bleeding till the blood was thin; purging till the body was wasted to a skeleton; and starving on vegetable diet to keep it so'."

Jenner found later on, after his return from London to set up in medical practice in his native village of Berkeley, that the tradition that cow-pox protected the milkers from small-pox was generally held, and about the year 1775 he began those enquiries which he continued with scientific patience for some years. In 1796 he made his first vital and complete experiment:

> Matter was taken from the hand of Sarah Nelmes who had been infected by her master's cows, and inserted by two superficial incisions into the arms of James Phipps, a healthy boy of about eight years old. He went through the disease apparently in a regular and satisfactory manner; but the most agitating part of the trial still remained to be performed. It was needful to ascertain whether he was secure from the contagion of smallpox. This point, so full of anxiety to Dr. Jenner, was fairly put to issue on the first of the following July. Variolous matter, immediately taken from a pustule, was carefully inserted by several incisions, but no disease followed.—(Baron, *Life of Jenner*, 1838.)

This is the principle of vaccination. It is probable that Jenner did not know that small-pox and cow-pox are either the same or a similar disease, but the fact remained that vaccination was unattended by risk, and that inoculation was dangerous.

Jenner, however, was not the man to rest content with one successful experiment, and before he published his conclusions he built up a chain of evidence so irresistible, that when he did publish, triumph was quickly attained.

In the year 1798 Jenner published through the house whose name will be seen on the title-page of the present book, his thin quarto announcing his discovery to the world: *An Inquiry into the Causes and Effects of the Variolae Vaccinae, a Disease*

Discovered in the Western Counties of England, particularly Gloucestershire, and Known by the Name of the Cow-Pox.

Perhaps no other scientist has ever won so immediate a crown to his labours, or with one discovery achieved such incalculable good. If the reader will look at the table (facing page 217) he will see one example of what vaccination has done.

Mention must be made here of the extension of the principle of immunization by means of what has come to be called vaccine-therapy, though having nothing to do with cow-pox, by the work of Sir Almroth Wright at St. Mary's Hospital. "Living but modified virus is used in small-pox and rabies; dead cultures are used in typhoid, pneumonia, plague and cholera."—(*Newman.*)

CHAPTER XIX

THE GROWTH OF HOSPITALS AND THE "SANITARY IDEA"

We now have to return to the beginning of the century to consider, in outline, the development of one of the greatest forces in modern medicine. Without the great city hospitals it is difficult to imagine what would now be the condition of medicine (leaving surgery out of the question) and of the mechanism of medical education. The plea for the support of the voluntary hospitals, urgent and constant as their needs are, is put with sufficient force and persistence to require no elaboration here. Their good deeds are not hidden but are wisely open for all who care to view them. But medicine itself owes almost as great a debt. Not only does every medical student have to "walk the hospitals" during the years of his graduation (the practice began at St. Bartholomew's Hospital in the seventeenth century) thereby gaining practical experience which his predecessors could only have in a much more limited degree and that at the risk of the patient supplying the experience, but after graduation he may, by aid of his hospital, keep himself informed of all newer methods. The large scale on which the hospitals work permits them to employ apparatus and methods which would be beyond the capacity of the individual practitioner. Moreover the modern conquest of disease has progressed to such a point that there are now diseases which the ordinary practitioner hardly ever sees in his private practice which, without the opportunity provided by multitudinous hospital patients, he might neither recognize nor succeed in treating.

And this great beneficent organization is, so far as England is concerned, a relatively modern growth. Though it may be regarded in its benevolent aspects as an inheritance of the medieval hospitals to which we have referred in Chapter VIII yet, as Miss R. M. Clay points out in her *Medieval Hospitals of England*, the pre-Reformation hospital was "an ecclesiastical not a medical institution. It was for care rather than cure; for the relief of the body when possible but pre-eminently for

the refreshment of the soul." There were about seven hundred and fifty of these hospitals in medieval England of which about two hundred were occupied by lepers. With the dissolution of the monasteries and the confiscation of religious endowments these institutions disappeared to be replaced, in part, by the almshouses of the sixteenth and seventeenth centuries.

As all the world has been clearly (and rightfully) informed the hospital of St. Bartholemew's founded in 1123 by Rahere, the jester who became a monk, survived the Dissolution, since it was re-founded by Henry VIII in 1544 after protest by London citizens in 1538. St. Thomas's was suppressed at the same time and re-founded under Edward VI. These are the only two hospitals that can claim continuity from medieval times. At the beginning of the eighteenth century, according to Dr. G. C. Peachey's *Evolution of the Eighteenth Century Hospital Movement*, the situation was rather surprisingly bad:

> The only public institutions in London for the reception and treatment of the sick poor were St. Bartholomew's and St. Thomas's Hospitals. In the provinces private charity was the sole alternative to parish relief.

Lunatics were incarcerated—not treated—in Bedlam (the Hospital of St. Mary of Bethlehem) and venereal cases were dealt with in two Lock Houses attached to St. Bartholomew's.

The spirit of philanthropy which we have noted as a characteristic of the century, began to glow in the early years, and in 1720 we find established, without flourish or public interest, the first of the new hospitals, the Westminster Infirmary, in Petty France, adjoining Tothill Fields, which, later transferred to Hyde Park Corner, became St. George's Hospital. In the next year the wealthy Thomas Guy, a bookseller, founded and endowed his great hospital, the only one, says Dr. Peachey, of the eighteenth century foundations which was independent of voluntary subscriptions. Guy's benefaction amounted to the enormous sum of £220,000, worth nearly two millions in present-day values. There followed in 1740 the London Hospital, and in 1745 the Middlesex. Maternity homes and lying-in hospitals were also started together with general and infant dispensaries. Dr. John Coakley Lettsom, founder of the Medical Society of London, in his *Hints respecting General Dispensaries* (1772), declared that "in the nurture and management of infants as well as in the treatment of lying-in women the reformation hath

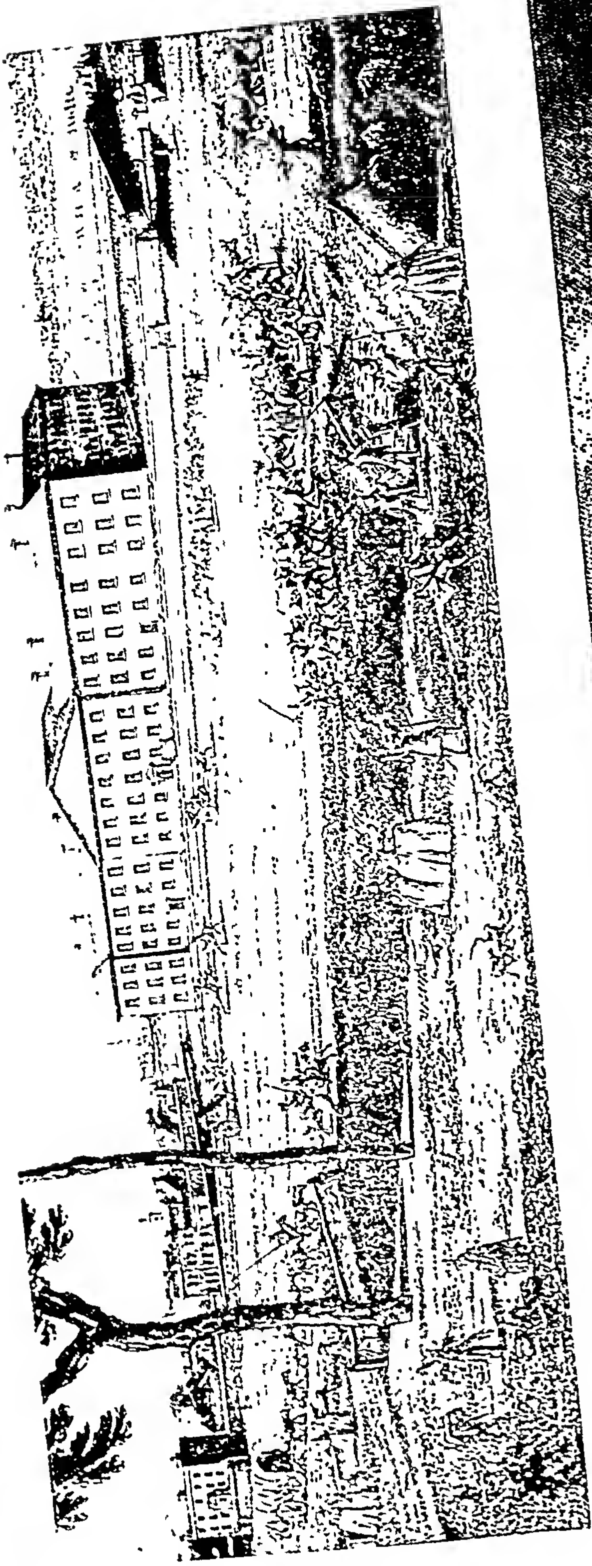
PLATE LIX

Two of London's New Hospitals in the First Half of the Eighteenth Century

The upper print shows one of the wards in the hospital so munificently founded by Thomas Guy and first opened on January 16th, 1725, "for the relief by physick or surgery of sick persons". The lower print (reproduced in part) gives a view of the London Hospital in the Whitechapel Road and its adjacent country. It was engraved from a painting by William Bellers, and published by him in 1753 dedicated to William, Duke of Devonshire, president and one of the governors of the hospital. The London Hospital began, as a result of the moving of the philanthropic spirit, in 1740, as a small infirmary in Featherstone Street, Whitechapel. Later it was transferred to the building seen here in Prescott Street, Goodman's Fields.

British Museum.

PLATE LIX



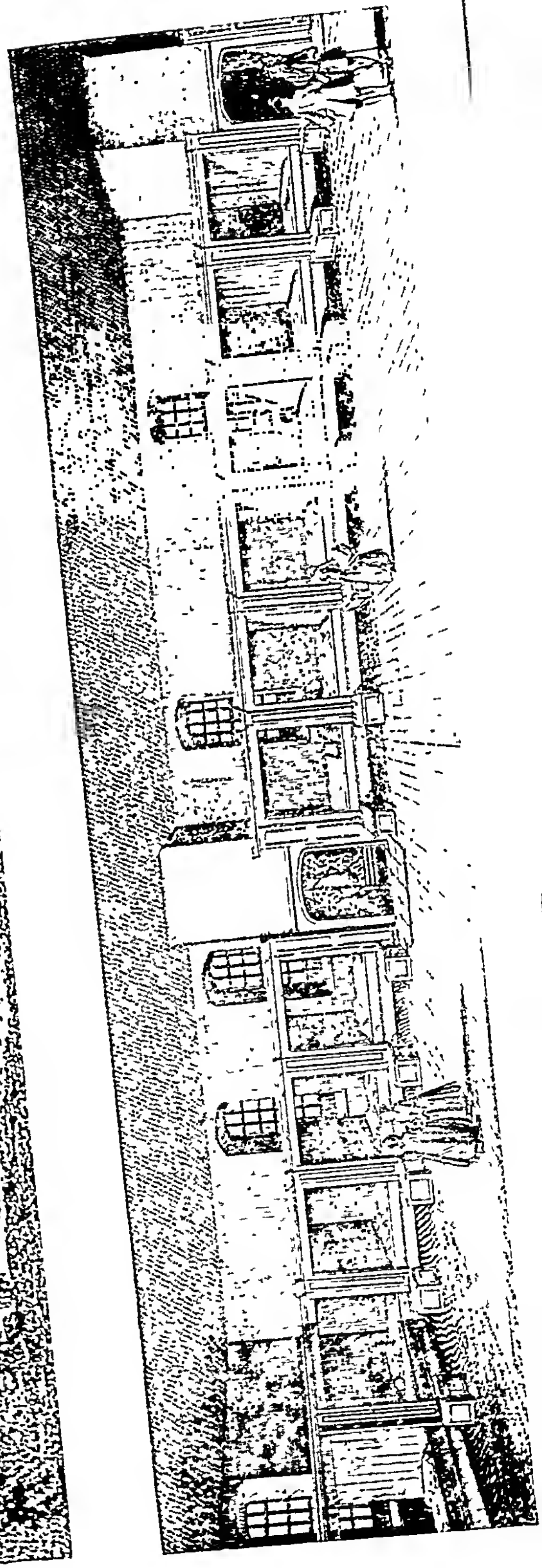


Plate LX

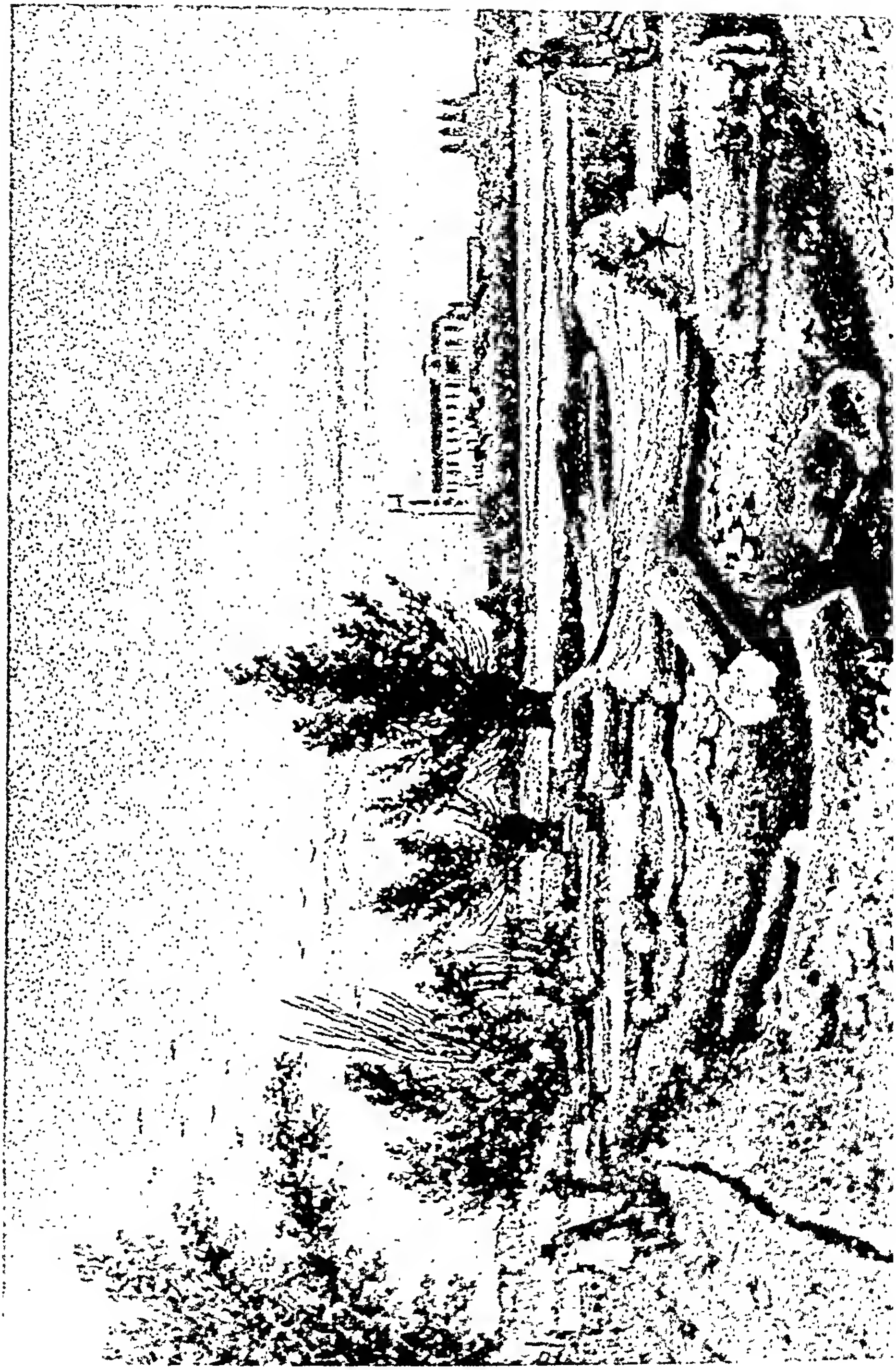


PLATE LX

London Breeding-Places for the Malaria Mosquito

Memories of the ills of other days are fortunately short, but it is nevertheless surprising to realise that as recently as 1860 malaria was a serious factor in London sickness (*see* page 129).

This view, drawn by J. T. Smith and published in 1808, of "The Grounds on the South of Westminster including the Timber-Yard on Millbank with Tothill Fields in the Distance," indicates the principal reason. Long stretches of the river bank, from above Chelsea down to the city, were marshy and provided plenty of the stagnant pools in which the mosquito loves to breed.

The embanking of the river removed, in a few years, the cause of a disease which had held sway for centuries. At the beginning of the twentieth century only one case of genuine native malaria could be found in the whole of England. A disease which was endemic in this country until fifty or sixty years ago is now rightly regarded as tropical.

Crace Collection, British Museum.

equalled that of the small-pox: by these two circumstances alone incredible numbers have been rescued from the grave."

Of the character of early hospital organization and treatment we cannot give a better picture than Dr. Peachey's description, details of which may be seen in contemporary engravings:

> At first no bathing accommodation whatever existed. . . . The floors, some of which, with the passages, were sanded, were washed at intervals, and occasionally sprinkled with vinegar. From time to time the beds were searched for vermin; the wards and bedding were fumigated with wormwood; chafing dishes and heaters were provided for the purpose of deodorisation; and it was not uncommon for nosegays to be ordered by the surgeon "to prevent the patient from being infected by the stench of his wounds."
>
> The wooden four-poster tester bedsteads were provided with curtains to exclude draughts in the winter months, and under each bed was a box or drawer to contain the patient's foul linen. The mattresses were mostly of straw. Coal, and sometimes wood, was burned to warm the wards, and tallow candles gave an uncertain light in the dark hours.
>
> The sexes were placed in different wards, but medical and surgical cases of every description lay side by side, and it was not always that each patient had a separate bed.
>
> The nursing was of a primitive character, the nurses being mostly widows, more or less addicted to drink, while the night nurses, then called "watches", consisted of those who were qualifying for the posts occupied by their more experienced seniors.

The hospitals of those and even later days were by no means health centres as the term "hospital fever" (i.e. typhus, of which many died) indicates. Putrid atmospheres, crowded beds and an utter carelessness of cleanliness and the dangers of infection, as we understand them, inevitably meant a high death-rate. Pringle's significant note on hospital ventilation has already been quoted (see page 195). Nevertheless the debt to the "new humanity" of the eighteenth century remains a large one.

Even more important for the general weal of the patient outside the hospitals was the revolution in medical teaching which resulted from the new hospital system. Sir George Newman's note is apposite:

> The London hospitals made informal arrangements with their medical staffs that their private apprentices should take a course of hospital work under their supervision. Thus the private apprenticeship system became something of a communal apprenticeship system in the hospitals. The medical staff became a medical faculty, and the apprentices became clerks and dressers in the wards.

> The third step was the holding of private classes in chemistry, anatomy and pathology, and of clinical classes at the hospital. Before John Hunter, surgery was well taught only in Paris, and before the Monros began at Edinburgh anatomy flourished only on the Continent. Private instruction, such as that of Cheselden and Pott, Smellie's school of obstetrics, the Hunters' school of anatomy and surgery, Baillie's classes in morbid anatomy, and Harrison and Blizard's clinical class at the London Hospital, was the beginning of modern ways.

The "passionate impulse of sympathy with the wronged and afflicted," as John Richard Green names the movement exemplified by the "new humanity" of the Wesleys, of John Howard and his pioneer work in prison and lazaretto hygiene, of Thomas Clarkson and Samuel Wilberforce in their crusade against oppression of man by his fellows, and of many another of the eighteenth and nineteenth century humanists, the contemplation of whose splendid efforts still warms the blood, all this activity had close and direct connection with the public health movement. Beginning in the days of the Industrial Revolution with the shifting of large masses of the population from the country to the town, it was not until late in the nineteenth century that a really effective Public Health Act brought these efforts to fruition. Various detailed improvements (including public vaccination for small-pox already discussed) and an immense amount of public education in the ideas of hygiene and sanitation and their fundamental necessity, had been achieved, but it was not until the Sanitary Act of 1866 that regular and specific hygienic responsibility was thrown upon local authorities throughout the country. Before that local action had been permissive, not imperative, with the natural result that a few enlightened public bodies had taken fair advantage of the increasing medical knowledge while most of the rest of the country wallowed in an unhygienic squalor not greatly superior to that of the Middle Ages themselves.

The reader may think that a statement so drastic is but sensationalism out of place. It is important to emphasize that, close as it comes to our own day, the early and mid-Victorian epoch was, from the hygienic and sanitary aspect, an epoch of most unsanitary filth. Consider the following facts.

In 1838 and 1839 Drs. Arnott, Phillips Kay and Southwood Smith made reports to the Home Secretary on preventable causes of fever and sickness in London. They showed that, under parliamentary sufferance, masses of the population were

denied the possibility of healthy life; that while considerable efforts had been made to improve conditions in the wealthier districts nothing whatever had been done to improve the condition of those inhabited by the poor.

> Crowded in courts and alleys and narrow streets almost insusceptible of ventilation, in dwellings which themselves were often not fit to be inhabited by human beings; while, all around the dwellings, the utter absence of drainage, the utter omission of scavenging and nuisance-prevention, and utter insufficiency of water supply, conduced to such accumulations of animal and vegetable refuse, and to such pondings of ordurous liquids, as made one universal atmosphere of filth and stink.

That this was no matter of an isolated slum is shown by Dr. Southwood Smith's figures which, he said, "indicate some of the final results of the suffering" caused by such conditions. He was investigating fever alone and his returns showed that out of 77,000 persons 14,000 were attacked by fever of whom 1,300 died—in 1839. Those figures related to Bethnal Green and Whitechapel only, a considerable area; but only a portion of a "poor London" over which similar conditions were repeated again and again.

Then consider the quality of the water supply after the middle of the century.

From 1831 onwards Asiatic cholera had been epidemic in this country, claiming huge numbers of victims at the peak periods. In 1854 an enquiry was instituted by the ill-fated and short-lived Board of Health as to the possible association between cholera and diarrhoeal disease and bad water, the results of which were published by Sir John Simon, medical officer to the Board, in 1856.

In South London in 1854 out of a population of more than five hundred thousand two epidemic periods had resulted in the death of over fifteen thousand people from the two diseases. The main water supply was provided by two companies, the Lambeth and the Southwark, which drew their water from the Thames then grossly polluted with sewage water, which Sir John describes, shortly, as "foul." In the period 1853–54 the Lambeth Company changed its intake, and drew its supplies from a higher and relatively clean part of the river while the Southwark drew from an exceedingly polluted part. The Board made a careful census of the population according to the water used and found that the cholera death rates per ten thousand

in 1854 were divided thus among the sad martyrs of an insanitary time:

Death rates among those using the foulest water .	130
Death rates among those using improved water supply	37

It seems extraordinary to us that facts so simple should have to be established by methods so laborious and to the unfortunates concerned, so murderous, but such was the depth of hygienic ignorance and so strong the forces of vested interests and *laissez faire* that, even after the Sanitary Act of 1866, Sir John Simon in his Reports to the Privy Council of 1867 found it necessary to point out—

> how utterly unprotected the public still was against the vast injuries which purveyors of water-supply could inflict, and how urgently it was needed that the purveyors who wielded this colossal power of life and death should be severely punishable at law for any wilful or neglectful distribution of polluted water.

Writing in 1889 in his *English Sanitary Institutions* he returns to the charge:

> That even the London water-supply, after half a century of disgusting disclosures, and after various very terrible disasters, is not yet secured against gross defilement, is a fact to be sufficiently gathered from the reports of the official examiner under the Metropolis Water Act, 1871, and is in other ways deplorably notorious.

So slow is even urgent reform. It was not until 1902 that the Metropolitan Water Board was established. Even the sewage-fouled water was, until after 1830, only supplied intermittently on three days in the week.

The fight for improvement in hygiene and sanitation was long and arduous and we do not propose to recount its details here, horrifying though some of them are to modern ears. Valiantly as the pioneers fought they made but slow headway against the hideous, man-slaying inertia of ignorance, laziness and vested interests. One of the reasons for the slowness of change was the lack of public knowledge and public sympathy with the objects and actions of the pioneers. It is as impossible to make a people healthy by order as it is to make them moral. They can only be made one or the other by educated consent. While they are ignorant of sanitary principles they cannot but be impatient with the reforming zeal that is urged to disturb their

ancient fetid comfort. If filth about a house makes a stink, why, burn some sweet smelling herbs to counteract it.

In general this may be taken as applying indifferently to eighteenth or nineteenth century despite the advances in knowledge recorded in Chapter XVI. The factors of ignorance, on one hand, and natural patience and indignation at preventable suffering, on the other, ended in 1854 the six-year life of the Board of Health and the official career of its chief figure, Edwin Chadwick (died at ninety in 1890 and knighted only a year before), a man of burning energy and the apostle of the "sanitary idea." Political influences, nineteenth century horror at the expense of his hygienic proposals and ignorance in places high and low, all factors which his slightly intolerant zeal undervalued apparently checked his efforts but his immense volume of and public hygienic work alone suffice for his recognition as the founder of our modern public health and a life-saver of the highest order. Chadwick's most lasting memorial is, perhaps, his introduction of glazed earthenware pipes for domestic and town drains, now used in nearly all civilized communities. Sir John Simon declared it "the most valuable sanitary contrivance which had been introduced since Roman times."

Other pioneers of those stormy days were Southwood Smith (died 1861), who was physician to the London Fever Hospital and an active member of the Board of Health, also published valuable official reports on the condition of the poor (see page 223), cholera, yellow fever, quarantine and various sanitary matters, and Sir John Simon whom we have already quoted. When, in 1854, political quarrels and the jealousy of those whose interests and manner of life were interfered with enabled the opponents of hygienic progress to demolish the Board of Health, it was Simon who carried forward the torch of health for the next seventeen years until his great Sanitary Act became law in 1866. Various additional measures followed until in 1871 when, with the establishment of the Local Government Board for the supervision and direction of the unco-ordinated work of local authorities, a peak of progress in public health was reached, he could say that:

> The sanitary laws had been made tolerably complete . . . legislation . . . had given . . . greatly increased means of self-protection against sanitary wrong. Meanwhile we had left far behind the hostilities and suspicions which, when we first entered on duty, were extensively roused by any mention of sanitary progress.

There was in fact "a constantly increasing public interest" in matters of health. In all, no bad monument to a life of effort for the public weal by no means concluded at this point. Even with the establishment of the Local Government Board administrative lack of vision still compelled medicine to play but a minor part in preserving the people's health. Its forces were not liberated until the Ministry of Health was set up in 1919. Chadwick and Simon remain the two great figures in the early history of our public health.

It is difficult for the twentieth century householder to realize that his apparently secure and serene hygienic condition, his ample, pure water, his cleanly water-borne sewage, his scavenged roads and streets, his reasonably well-drained countryside, the almost complete absence of any kind of "nuisance" are the semi-miraculous results of little more than half a century's battling by a few pioneers and not the sum of several centuries' progress. That, in fact, while medicine itself has long been in advance its application to sanitation is only now back at the level (or perhaps slightly above) of that of Minoan Crete and Rome, thirty-five and twenty centuries ago.

Having paid the duty of this fleeting glance at the hospitals and sanitation of the two centuries it is necessary to turn back to the beginning of the nineteenth to present a few notes on its great achievements in medicine, achievements so great that Sir George Newman styles the period "the Golden Age of Medicine."

CHAPTER XX

NOTES ON THE EPOCH OF MODERN MEDICINE

THE END of the eighteenth and the beginning of the nineteenth century is a convenient time to refer to a subject on which the medical profession had not the slightest reason to congratulate itself, the care of the insane. The cure was certainly beyond it. No better short account of the state of affairs can be given than the following passage from Dr. Arnold Chaplin's *Medicine During the Reign of George III*. We should like in passing to acknowledge the great debt we are under to this book, than which nothing better in a short space has been done.

> To appreciate the whole squalid story of the manner in which the insane were cared for and treated in the reign of George III, it is necessary to read the evidence given before the Committee of the House of Commons in the years 1813–15. That evidence recounts such acts of cruelty and callous negligence that go far beyond the wildest flights of the imagination of the uninstructed writer of romance. These poor creatures were beaten, starved, and manacled for acts over which they had no control. For months at a time they were cast into filthy dungeons with no light or clothing, and with only excrement-sodden straw on which to lie. Amputations of the fingers and toes, on account of frost-bite, were by no means uncommon. The practice of feeding by force was often resorted to, not on account of refusal to take food, but as a punishment, and from the barbarous method employed death from suffocation was often the result. It rested with the keepers of the madhouse to decide whether an enquiry before a coroner should take place in case of sudden death, and it was given in evidence that the jurors were often chosen by the keeper.
>
> Nearly all the madhouses in London, of which there were thirty-seven, were managed by people who had been keepers in similar institutions, and an apothecary was called in to attend those who were sick. Rank of patients procured no amelioration of their wretched state. A captain of the Guards was beaten by a keeper so severely that he died, and a colonel was confined in a cell for several months naked, with nothing but dirty straw for a bed. A smith in London Wall prospered in his business on account of his special skill in forging fetters and chains for the hapless lunatic. If the madman made a noise he was gagged. In many places rats swarmed, and one witness swore that he had seen a patient call by

name from their holes forty rats that she had tamed. Rat bites were common, and vermin infested the cells.

No attempt at medical treatment of the insane was made, and the physicans appointed to inspect these places did their work in the most perfunctory manner. Violent patients were bled till they became exhausted, and acts of immorality sometimes took place between the keepers and the female patients.

After this it is like a breath of cool summer air to read of the founding of The Retreat at York [Plate 62] in the year 1792 by that good Quaker, William Tuke (1732–1822). There had been trouble at York Lunatic Asylum over the treatment of a patient, a Quaker, whose friends were refused admission to see her. This case, in addition to what he saw on a visit to St. Luke's Hospital, London [Plate 61], roused all the pity and all the desire to do something to ameliorate the condition of the insane in William Tuke. He consulted with other Friends, and the result was the foundation of an institution for the reception and care of the insane, which by its example gradually did more perhaps than anything else in this country to reverse the whole attitude of men towards insanity.

The idea was that the place should be really a *Retreat*, "a place in which the unhappy might obtain a refuge; a quiet haven in which the shattered bark might find the means of reparation or of safety." It is still flourishing. There were no chains, no irons, no bars or gratings to the windows, and no secrecy. No tribute could be more moving in its pathos than the following anecdote:

> A patient was admitted who had nearly lost the use of his limbs from being chained, and for some time it was necessary to lead him about like an infant. He was found to require no restraint, and was, after a while, able to walk without assistance. When one of his friends visited him and asked him what he called the place, he replied, with great earnestness, "Eden, Eden, Eden!"

Sydney Smith wrote of The Retreat in the *Edinburgh Review*, April, 1814:

> When a madman does not do what he is bid to do, the shortest method, to be sure, is to knock him down; and straps and chains are the species of prohibitions which are the least frequently disregarded. But the Society of Friends seems rather to consult the interest of the patient than the ease of his keeper. and to aim at the government of the insane by creating in them the kindest disposition towards those who have the command over them.

PLATE LXI

St. Luke's Hospital for Lunatics

This impressive picture, the work of two masters, Rowlandson, the caricaturist, and Pugin, the Gothic architect, conveys perhaps better than even the contemporary prints of patients in chains and manacles, the despair and hopelessness of the asylum life of those days. The date is about 1809, and the Plate is from a fine aquatint by J. C. Stadler. St. Luke's Hospital for Lunatics, was founded in 1751, as Bethlem was then insufficient for public needs. It was in Upper Moorfields. A new building was opened in 1787 and was in Old Street. The architect was George Dance, the architect of Newgate. The conditions at St. Luke's were not at the low level of Bethlem and other asylums, but Samuel Tuke, writing in 1812, says; "The building has entirely the appearance of a place of confinement, enclosed by high walls, and there are strong iron grates to the windows. Many of the windows are not glazed, but have inner shutters, which are closed at night. On the whole, I think St. Luke stands in need of a radical reform".

From the Collection of Dr. H. J. Norman.

PLATE LXI

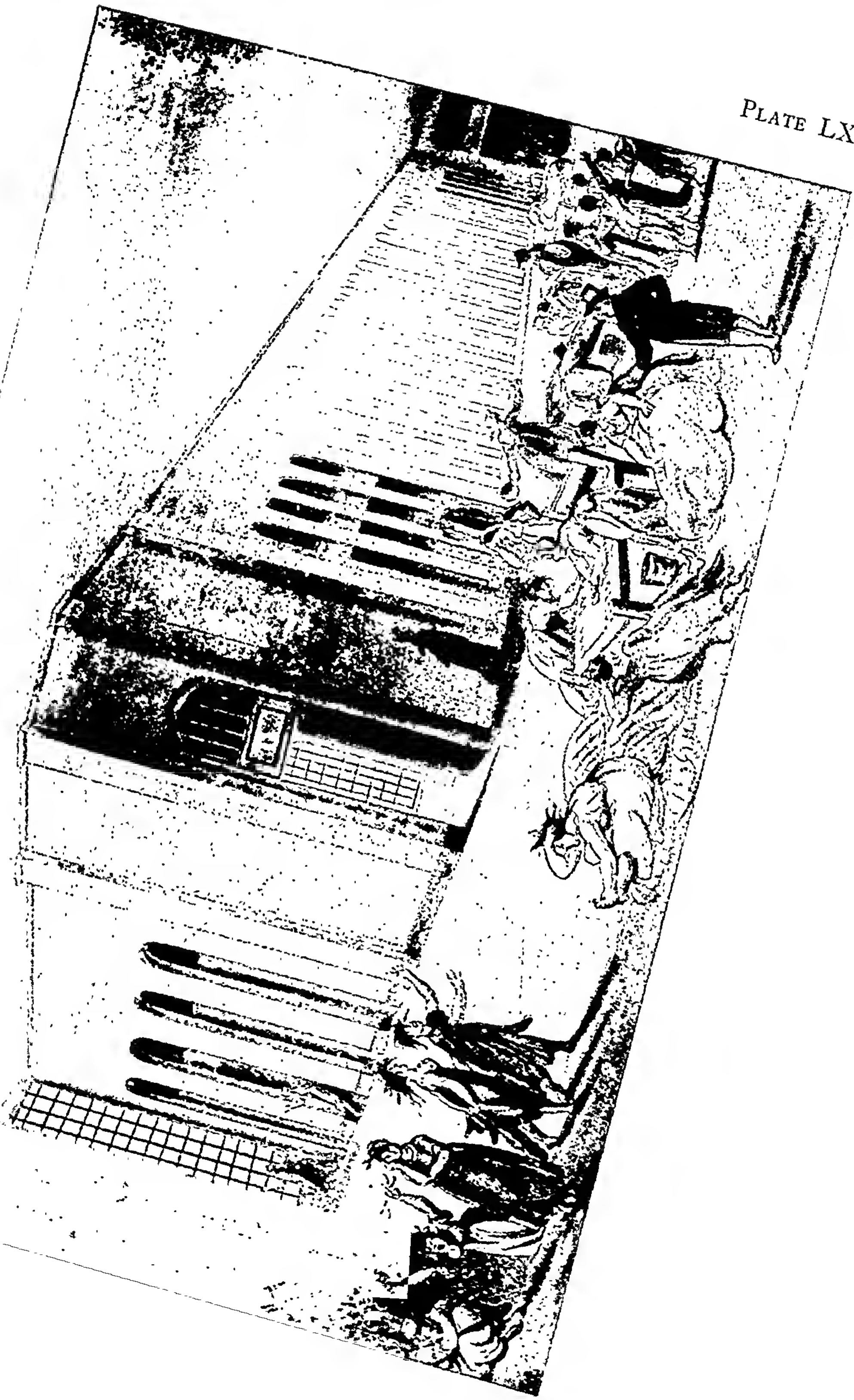
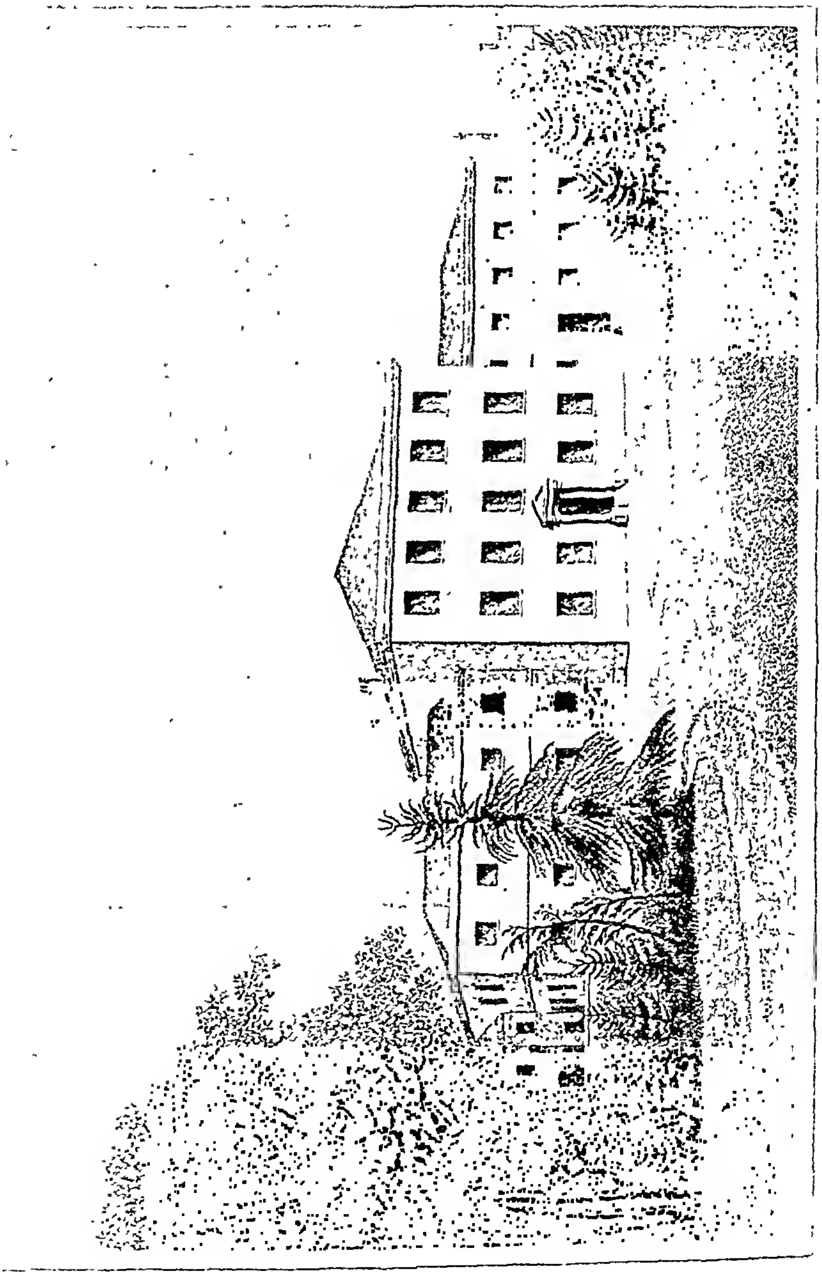


PLATE LXII



PERSPECTIVE VIEW of the NORTH FRONT of the RETREAT near YORK.

PLATE LXII

THE RETREAT, AN INSTITUTION NEAR YORK, FOR INSANE PERSONS

It was The Retreat, founded in 1792 by William Tuke, a Quaker, that set the great example in England for the reform of the treatment of the insane.

Title page from Tuke's *Description of the Retreat*, 1813.

From the Collection of Dr. H. J. Norman.

Help for the insane was also coming on the continent. Philippe Pinel (1745–1826), who was physician to the Bicêtre, and afterwards to the Salpêtrière, in Paris, freed his patients from their chains. He was followed in England by Gardiner Hill, who in 1836 introduced the No Restraint system into Lincoln Asylum, and in 1839 John Conolly did the same thing at Hanwell. Since that period conditions by force of law and right feeling have gradually improved, and probably, if statistics were to hand, more cases of insanity arrested would appear than might be suspected. What is the most hopeful thing that can be said for the prospects of the cure of insanity? Mankind always expects the physician to produce some magic potion, but so far the physician has been singularly unable to produce it for the cure of the mind. Will he do so, or is this the insoluble mystery?

Pathological and physiological research have advanced our knowledge of the structure and function of the nervous system very greatly. This is particularly so in the matter of microscopic investigation, where higher-power lenses have made it possible to see intimate details and changes which were before only inferential. Experimentally it has been "proved conclusively that whether we call a person fatigued or diseased, the brain-cells undergo physical deterioration accompanied by loss of mental power. Even to the minutest detail we can show a direct relationship between the physical state of the brain-cells and the mental power of the individual —that is, the physical power of a person goes *pari-passu* with his mental power".—(*Crile.*)

Many others have come to the same conclusion, and it may safely be anticipated that further investigation will confirm and amplify the results already arrived at. The finding of micro-organisms in the brain—as, for example, in general paralysis of the insane—has been rendered possible by the use of the modern methods of investigation, and the discovery of other noxious organisms may throw light on the hitherto obscure ætiology of certain mental disorders.—(*Dr. Hubert J. Norman*, "*Evolutional Progress in Psychiatry*", 1918.)

Without attempting to draw any general conclusions, we might note as an extraordinary instance of modern methods, both of research and of therapy, the discovery made in recent years that general paralysis of the insane, which is always in alliance with syphilis, can be alleviated and sometimes cured by artificially inducing the infection of malaria. The malaria is cut short by administration of quinine, and the syphilis may later on be dealt with by other injections. Such a fact as this does encourage the hope that the science of treatment of insanity

will at some probably not far distant date grow up from its present infancy.

Early in the nineteenth century the study of diseases of the skin was set on its feet by Robert Willan (1757–1812), who in 1808 published the first volume of his great book *On Cutaneous Diseases*, a quarto containing coloured plates of extreme delicacy and beauty. He died before his life's work was completed, but it was continued by his pupil Thomas Bateman (1788–1831), who in 1817 completed Willan's book by bringing out his *Delineations of Cutaneous Diseases*, with plates as fine and delicate as those in the earlier volume. As we study these wonderful plates, and note the arrangement of the diseases under classes, we feel that a new science has suddenly emerged from the regions of guess-work and quackery. Willan had been influenced by the work of Matthew Baillie, and, as Dr. Arnold Chaplin points out, he held a class for clinical study at the Public Dispensary in Carey Street, where he and Bateman had as pupils two of the greatest of English pathologists, Richard Bright and Thomas Addison. Nowhere better than in medicine can we trace the beneficent and long train of influence of master on disciple, and so on through the generations. We have already observed it in the case of Harvey and the race of anatomists at Padua; we have seen it in the universal sway of Boerhaave and its blossoming in the great Edinburgh school; we see it here again in Morgagni and Matthew Baillie and Willan and Bright and Addison.

A most important development now began to take place, the application of chemistry to medicine and physiology, a movement that was initiated in England by Dr. William Prout, who, in 1821, published his *Enquiry into the Nature and Treatment of Gravel, Calculus, and other Diseases*. A Guy's man will tell us that at Guy's they also had their physicians who were pioneers in the application of chemistry to the human body, and he will be right. But Prout's was the greatest of the pioneer books in this direction. Guy's Hospital, as we shall see in a moment, was a wonderful centre for research in those days, and one of its physicians, Golding Bird (1814–54), was early in the adoption of electrotherapy, and wrote on the subject.

We have said a little about the rise of pathology and morbid anatomy in the eighteenth century. It is not possible to follow this subject very far in this book, as pathology is not a subject with which to tempt the general reader, and this is a book designed only to give him some accurate idea of the gradual

accretion of medical knowledge. He would be a tactless author who conducted his fair reader to the mortuary. But we should certainly like to associate in the reader's mind that most pleasant street, St. Thomas's Street, just below London Bridge, with its gracious old houses, its charming Queen Anne brick church now turned into a Chapter House, and the courtyard of Thomas Guy's great Hospital, we should like to associate all this with three great pathologists who were all connected with Guy's during the same golden period, and who all three have given their names to a disease. This last is a difficult sentence, ending, as it does, in an unpleasant anticlimax! But every Guy's man will understand our motive, and we must hasten to explain that it really is one of the chief glories of Guy's Hospital that it once contained as three colleagues, Richard Bright (1789–1858), Thomas Addison (1793–1860), and Thomas Hodgkin (1798–1866). It is not possible or desirable here to enter into the question of what Bright's Disease, Addison's Disease, and Hodgkin's Disease, actually are. It is merely desired to associate these three great names with Guy's Hospital, for no other hospital in the world can show such a remarkable record of three colleagues of the first rank whose names are classic eponyms.

We now approach that great generalization of which we saw the beginning in Robert Hooke's experiment with the piece of cork. In 1838 Theodor Schwann (1810–82), in conjunction with Matthias Jacob Schleiden (1804–81), worked out and enunciated on a microscopic basis a new theory of the structure of living tissue, and this has furnished the starting-point for all subsequent biological research. It is interesting to note that the Cell Theory was entirely due to the study of botany, and here is partly our justification for our long chapter on the beginnings of the microscope. "There is a principle of development common to the most different elementary parts of the organism, viz. cellular formation."

This theory Rudolph Virchow (1812–1902) developed and applied to pathology. Let us give in a translation from his own words the primary outline of this theory:

> What Schwann, however, has done for histology, has as yet been in a very slight degree built up and developed for pathology and it may be said that nothing has penetrated less deeply into the minds of all than the cell-theory in its intimate connection with pathology.
>
> If we consider the extraordinary influence which Bichat in his time exercised upon the state of medical opinion, it is indeed astonishing that such a relatively long period should have elapsed since

Schwann made his great discoveries, without the real importance of the new facts having been duly appreciated. This has certainly been essentially due to the great incompleteness of our knowledge with regard to the intimate structure of our tissues which has continued to exist until quite recently, and, as we are sorry to be obliged to confess, still even now prevails with regard to many points of histology to such a degree, that we scarcely know in favour of what to decide.

Especial difficulty has been found in answering the question, from what parts of the body action really proceeds—what parts are active, what passive; and yet it is already quite possible to come to a definitive conclusion upon this point, even in the case of parts the structure of which is still disputed. The chief point in this application of histology to pathology is to obtain a recognition of the fact, that the cell is really the ultimate morphological element in which there is any manifestation of life, and that we must not transfer the seat of real action to any point beyond the cell. Before you, I shall have no particular reason to justify myself, if in this respect I make a quite special reservation in favour of life. But I think that we must look upon this as certain, that, however much of the more delicate interchange of matter, which takes place within a cell, may not concern the material structure as a whole, yet the real action does proceed from the structure as such, and that the living element only maintains its activity as long as it really presents itself to us an as independent whole.

In this question it is of primary importance (and you will excuse my dwelling a little upon this point, as it is one which is still a matter of dispute) that we should determine what is really to be understood by the term cell. Quite at the beginning of the latest phase of histological development, great difficulties sprang up in crowds with regard to this matter. Schwann, as you no doubt recollect, following immediately in the footsteps of Schleiden, interpreted his observations according to botanical standards, so that all the doctrines of vegetable physiology were invoked, in a greater or less degree, to decide questions relating to the physiology of animal bodies. Vegetable cells, however, in the light in which they were at that time universally, and as they are even now also frequently regarded, are structures, whose identity with what we call animal cells cannot be admitted without reserve.

It is only when we adhere to this view of the matter, when we separate from the cell all that has been added to it by an after-development, that we obtain a simple, homogeneous, extremely monotonous structure, recurring with extraordinary constancy in living organisms. But just this very constancy forms the best criterion of our having before us in this structure one of those really elementary bodies, to be built up of which is eminently characteristic of every living thing—without the pre-existence of which no living forms arise, and to which continuance and the maintenance of life is intimately attached. Only since our idea of a cell has assumed this severe form—and I am somewhat proud of having always, in spite of the reproach of pedantry, firmly adhered to it—only since that time can it be said that a simple form has been

PLATE LXIII

Memorial of the First Cure of Rabies

Rabies, or hydrophobia, is an acute infective disease communicated by the bite of a rabid dog and a few other animals. While the causative organism still remains unknown, it is one of the many triumphs of Louis Pasteur that he should have recognised the existence of a virus, and have successfully prepared a vaccine which, thanks to the long incubation period of the disease—varying from six weeks to three months after the rabid bite is received—normally succeeds in preventing the development of the disease itself.

Large numbers of lives have been saved, including that of the Alsatian shepherd boy represented in this monument in the Gardens of the Institut Pasteur, Paris. He was bitten by a wolf, and was the first to receive Pasteur's treatment.

Courtesy of William Martin-Hurst.

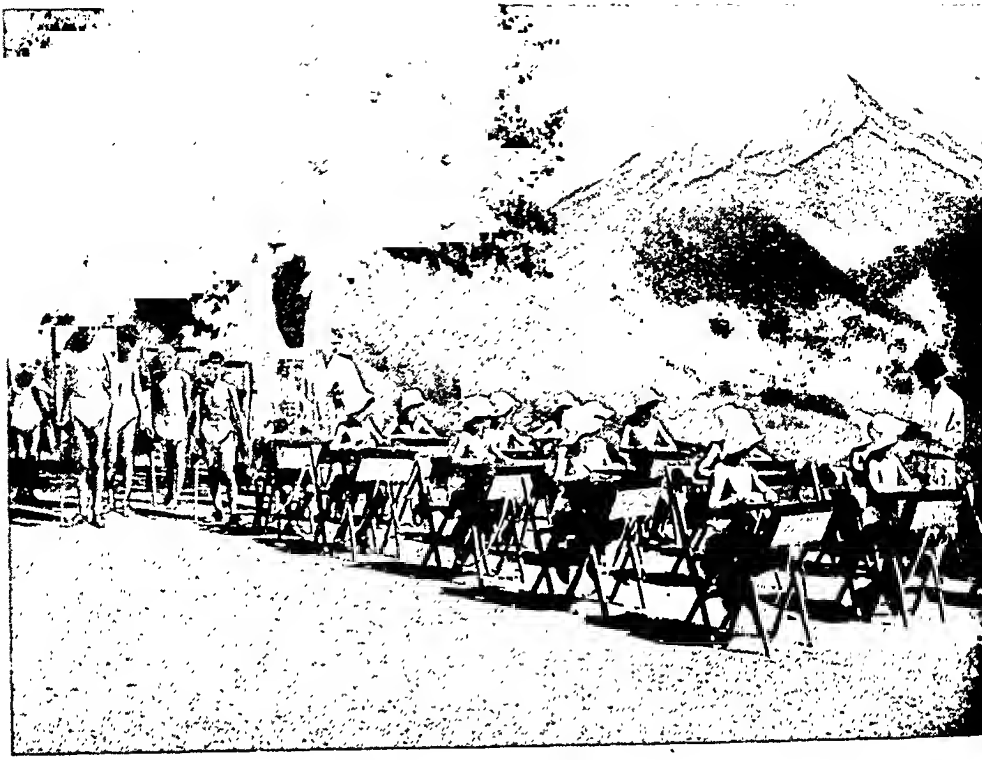


PLATE LXIV

Two Outstanding Methods in Modern Medicine

Since the curative and preventive properties of sunlight were recognised by T. A. Palm (*see* page 235), the twentieth century has seen widespread remedial development of its use. Heliotherapy has been particularly successful in cases of rickets and surgical tuberculosis, tuberculosis of the bones, joints, glands or peritoneum. It has displaced the drastic methods of operative interference, and in the hands of practitioners like Dr. Auguste Rollier, director of the great heliotherapeutic establishments at Leysin, Switzerland, has achieved very large numbers of complete cure of what would otherwise have been hopeless or mutilated cases. The sun treatment is combined with work as in the case of the photograph of the "school in the sun", opened in 1910 at Cergnat, Vallée des Ormonts, for children predisposed to tuberculosis.

Courtesy of Dr. Rollier.

In the lower photograph another instrument of modern medicine is illustrated. X-rays, discovered by Röntgen in 1895, are now used in almost every branch of medical work. Their application to diagnosis of many varieties of regional disease or derangement, is obvious, but great experience and skill are required, both in the production and interpretation of reliable skiagrams, and developments in technique are still taking place. The photograph shews a skiagram being prepared in the X-Ray Department of St. Bartholomew's Hospital. Note the operator's protective apron and the vertical lead screen in front, necessary precautions against X-ray dermatitis in those constantly exposed to the rays.

obtained which we can everywhere again expect to find, and which, though different in size and external shape, is yet always identical in its essential constituents.—(*Translated by Chance*, 1863.)

Virchow had arrived at that fundamental discovery about the human body, that it is an army or a structure of separate cells, each having its own life, each a citizen of no mean city. He expressed the new truth in the saying *Omnis cellula e cellula*, and this was intended to clinch the fact that the cells themselves were reproductive, and that in future all growth and all mistakes or aberrations of growth, or what we call disease, were to be referred to the cells. It was a great simplification, and cleared away the old mists of surmise and the old theorizing in the dark. The next problem of medicine was to take the new working truth, and to find out by patient experiment and discovery how it was to be made to modify the old practice and expand and develop a new practice of therapeutics.

He proceeded to rebuild pathology on his true conception of the human body as an organized cell state, a social system of continuous development, in which each microscopic unit performed its part. All fields of pathology were cleared by the new knowledge. Inflammation, tumour growth, degenerations, etc., were to be thought of now in their cellular relations, and in each of these fields Virchow himself led the way in bringing about the change. The physician of to-day can scarcely conceive how great a revolution this was. One who from his earliest student days has heard every phase of anatomy, embryology, neurology, physiology and pathology discussed in terms of cells, can hardly picture a state of medical knowledge in which these cells had no part. We are all cellular pathologists to-day, taking our post-Virchovian cellular sense for granted.—(*Long*, "*History of Pathology*".)

In these words does Dr. Esmond R. Long remind us that before the days of the nineteenth century triumphs in bacteriology, the way had been prepared for entirely new campaigns.

Henceforward the greatest name in medical science of the nineteenth century is that of Louis Pasteur (1822–95). His victories in the field of bacteriology, his utter slaying of the old doctrine of spontaneous generation, his triumphs over anthrax and hydrophobia, form perhaps the most extraordinary epic of the laboratory that has been or will be. Pasteur studied the subject of ferments, and proved that fermentation was caused not by a chemical but by a living agent, that is, that fermentation is bacteriological. Pasteur solved the apparently insoluble mystery of anthrax, and succeeded by inoculating

cattle with an attenuated virus in stamping out a scourge so ancient that it is believed to be the murrain of the Egyptians. But it is doubtless with his work in connection with hydrophobia that his name is popularly known. And yet, what of all Pasteur's achievements is the greatest? Certainly not the least is the fact that owing to his researches and discoveries in bacteriology Lister was enabled to create antiseptic surgery and revolutionize every surgical operation, major or minor, that has taken place since the 'seventies of last century.

It was Robert Koch (1843–1910) who established the technique of bacteriology, but he will be remembercd always because in 1882 he discovered the tubercle bacillus.

We have now traced the main lines of development in medicine and hygiene from the earliest indications to the threshold of its flowering in the modern world. At this point the stage becomes so crowded, the victories so constant, that it would obviously be impossible to consider them in a few pages, or to view them in the proper perspective. We are too near the immense volume of work of the last five or six decades to see it in a hurried glance, or to do justice to the hundreds of honoured names that crowd the golden pages of this Book of Life. Twentieth-century medicine is very largely the work of the specialist, and the work and achievement of specialization can only be appreciated by those whose years have been given to the solution of similar problems and the slow and patient wresting of secrets from tissues and organisms of infinitesimal size.

But before leaving the field on which we have seen so many battles waged over so immense a space of time, let us ask ourselves what actually are the definite victories which man may set down to his credit against the forces of disease and death?

Small-pox we have seen conquered by the inductive reasoning of a country doctor. Syphilis, that ancient enemy, the germ of which was discovered in 1905, can now be dealt with if taken in the early stages, and much can be done to stem its more advanced progress. Paul Ehrlich (1854–1915) at his six hundred and sixth experiment succeeded with a preparation of arsenic in evolving at last a specific for the hitherto unconquerable foe.

Diphtheria, in some respects the most terrifying of the enemies of man, because of the deathly speed of its action, has been countered with an antitoxin. Malaria has been controlled [Plate 60]. Tetanus has also been met with an antitoxin. Typhus has

been eliminated by an understanding of its origin in lice as carriers, and consequent measures of hygiene and cleanliness. Plague can be dealt with by hygienic measures, though it might at any moment be an enemy at the door, and cholera has long disappeared from truly civilized countries.

There remain two scourges, consumption and cancer, one the most insidious, the other the most frightful, of diseases. In spite of increasing hope and advance in treatment it cannot be claimed that they have yet been conquered. In connection with consumption it is startling to come on the following passage in a medical book of the eighteenth century, *Observations Medical and Political*, by W. Black, M.D., London, 1781:

> Seeing that such multitudes die of consumptions in London, and knowing that pure air is at least equal to diet or medicines in this direful distemper, would not 2 or 3 hospitals, built for consumptive patients, at a few miles distance from London, save hundreds of lives annually? Each great town hospital, and above all, those buried in the centre of the metropolis, should contribute their share. There are great numbers in such indigent circumstances in London, that to save their lives, they could not afford the expence of country lodgings. Perhaps a fund appropriated to support the consumptive in the country, would answer equally well, or even be preferable.

Wise and enlightened Dr. Black! But were he here to-day, should we be able to assure him that we had solved the problem of the consumptive when the patient has to return to the town from the fresh air of the country?

Neither have we any specific or vaccine which entirely deals with influenza, the common cold, or rheumatism.

The tendency of medicine is towards immunization, and of this the virtual founder was Elie Metchnikoff (1845–1916), who with his discovery of "phagocytes" and their artificial stimulation opened up a new field of treatment.

The most youthful of the subjects which engage the attention of the medical scientist are gland-therapy, vitamins, sunlight-therapy, and the conquest of diabetes by insulin, a pancreatic secretion whose constitution is unknown. Its discovery was announced by Dr. Banting of Toronto in 1921. The real discoverer of the preventive and curative properties of sunshine was an unassuming country practitioner, Theobald Adrian Palm (1848–1928). He was an Edinburgh man, and in the 'seventies of last century was sent by the Edinburgh Medical Missionary Society to Japan. He was there for some years

and became interested in the subject of rickets and the extraordinary fact of its almost entire absence from the countries of the East which enjoyed continual sunshine, and where the children, although living often in the most unhygienic and unfavourable dietetic conditions, yet were free from rickets. He was zealous in obtaining data and particulars of their experience from other medical missionaries in many countries of the East, and found that his hypothesis was true, that rickets and sunshine never went together. He contributed two articles of the subject to *The Practitioner* in the year 1890, where the data which he had collected, and his enlightened conclusions, are given at length. On his return to England Palm was engaged in private practice, first at Thorncombe, in Somerset, then at Wigton, in Cumberland, and finally at Aylesford, in Kent. He had, like Walter Pater, Dutch blood in his veins, and there is some resemblance between Palm and Rothenstein's drawing of Pater. At Aylesford he seemed to exhibit something of the quiet poise of nature. His spare time would be spent with his books, his eyes would gleam in conversation with a quiet enjoyment, and he might be met in the lanes, a brown figure, on his way to a distant patient on his bicycle.

It is to such men as these, patient and unselfish observers, that medicine owes much. It is often said that the future of medicine is in the laboratory. Doubtless this is true, but it is through the agency of the devoted and observant practitioner that Health comes with healing in her wings. The problem will be to convey the knowledge gained in the laboratory to the one man who can put it to practical use.

SHORT BOOK LIST

(Mainly supplementary to Works mentioned in the text)

GENERAL

WITHINGTON, E. T.: *Medical History.* London, 1894 (out of print).
GARRISON FIELDING, H.: *History of Medicine.* Fourth Edition. London, 1929.
NEUBURGER, MAX (trans. by Ernest Playfair): *History of Medicine,* Vols. 1 and 2 (Part. 1). Oxford University Press, 1910.
SINGER, CHARLES: *A Short History of Medicine.* Oxford, 1928.
DAREMBERG, C.: *Histoire des Sciences Médicales.* Paris, 1870.
OSLER, SIR WILLIAM: *The Evolution of Modern Medicine.* New Haven, 1921.
BERDOE, EDWARD: *The Origin and Growth of the Healing Art.* London, 1893.
CAMAC, C. N. B.: *Epoch-making Contributions to Medicine, Surgery, and the Allied Sciences. Being reprints of those communications which first conveyed Epoch-making observations to the Scientific World, together with Biographical Sketches of the Observers.* Philadelphia, 1909. (Lister, Harvey, Auenbrugger, Laennec, Jenner, Anesthesia, Puerperal Fever.)
RICHARDSON, SIR BENJAMIN WARD: *Disciples of Aesculapius,* 2 vols. London, 1900. (Biographies of famous physicians and surgeons; an admirable introduction to medical history.)
FULTON, JOHN FARQUHAR: *Physiology.* New York, 1931. (A short history of Physiology.)
FULTON, JOHN FARQUHAR: *Selected Readings in the History of Physiology.* Springfield, Ill., 1930.
LONG, ESMOND R.: *Selected Readings in Pathology from Hippocrates to Virchow.* London, 1929.
LONG, ESMOND R.: *A History of Pathology.* London, 1928.
NEWSHOLME, SIR ARTHUR: *Evolution of Preventive Medicine.* London, 1927.

EARLY PERIODS

MOODIE, ROY L.: *Antiquity of Disease.* Chicago University Press, 1923.
MARETT, R. R.: *Psychology and Folklore.* London, 1920.
THOMPSON, R. CAMPBELL: *Assyrian Medical Texts from Originals in the British Museum.* 1923.
THOMPSON, R. CAMPBELL: Translations of above published in various papers in *Proceedings* of Royal Society of Medicine, *Proceedings* of Society of Biblical Archæology, *Revue d'Assyriologie,* etc., etc.
THOMPSON, R. CAMPBELL: *The Assyrian Herbal.* London, 1924.
DAWSON, WARREN R.: *Magician and Leech: A Study in the beginnings of Medicine with special Reference to Egypt.* London, 1929.
RUFFER, SIR MARC ARMAND: *Studies in the Palaeopathology of Egypt.* Chicago University Press, 1921.
SMITH, G. ELLIOT, and DAWSON, WARREN R.: *Egyptian Mummies.* London, 1924.

GREECE AND ROME

JONES, W. H. S.: *Hippocrates*, text and translation, 4 vols. Loeb Classical Library, 1923–1931.
JONES, W. H. S.: *The Doctor's Oath: an Essay in the History of Medicine.* Cambridge, 1924.
BROCK, A. J.: *Galen "On the Natural Faculties."* Loeb Classical Library. 1916.
ALLBUTT, SIR CLIFFORD: *Greek Medicine in Rome with Other Essays.* London, 1921.
CATON, RICHARD: *Temples and Ritual of Asklepios at Epidaurus and Athens.* 1900.
SINGER, CHARLES: *Greek Biology and Greek Medicine.* 1922.

MEDIEVAL PERIOD

COCKAYNE, OSWALD: *Leechdoms, Wortcunning and Starcraft of Early England.* 3 vols. Rolls Series, 1864–66.
SUDHOFF, PROF. KARL: *Essays in the History of Medicine.* New York, 1926.
Schola Salernitana, English Version by J. Harington, with history of the School, by F. R. Packard. London, 1922.
SINGER, CHARLES: *The Legend of Salerno.* London, 1917.
SINGER, CHARLES: *From Magic to Science.* London, 1928.
BROWNE, E. G.: *Arabian Medicine.* Cambridge, 1921.
CHOLMELEY, H. P.: *John of Gaddesden.* Oxford, 1912.
ALLBUTT, SIR CLIFFORD: *Historical Relations of Medicine and Surgery to the End of the Sixteenth Century.* 1905.
NOHL, J.: *The Black Death* (trans. C. H. Clarke). London, 1926.
WILSON, F. P.: *The Plague in Shakespeare's London.* 1927.
BELL, WALTER, G.: *The Great Plague in London, in 1665.* London, 1924.

THE MODERN PERIOD

SPRAT, THOMAS: *The History of the Royal Society of London for the Improving of Natural Knowledge*, The Third Edition, Corrected. London, 1722.
WELD, CHARLES RICHARD: *A History of the Royal Society*, 2 vols., London, 1848.
WEAVER, SIR LAWRENCE: *Sir Christopher Wren: Scientist, Scholar and Architect.* London, 1923.
FULTON, JOHN FARQUHAR: *A Bibliography of Robert Boyle.* Proc. Oxford Bibliographical Society, 1931.
GOODALL, CHARLES: *The Royal College of Physicians of London Founded and Established by Law . . . and an Historical Account of the College's Proceedings against Empiricks and Unlicensed Practisers . . . from their First Incorporation to the Murther of the Royal Martyr, King Charles I.* London, 1684.
FOSTER, SIR MICHAEL: *Lectures on the History of Physiology during the Sixteenth, Seventeenth, and Eighteenth Centuries.* Cambridge, 1901.
OSLER, SIR WILLIAM: *An Alabama Student and other Biographical Essays.* Oxford, 1908. (Fracastoro, Harvey, Sir Thomas Browne, John Locke as a physician, etc.)
SYDENHAM, THOMAS: *Selected Works of Thomas Sydenham, M.D., with a Short Biography and Explanatory Notes*, by John D. Comrie. London, 1922.
PAYNE, JOSEPH FRANK: *Thomas Sydenham* (Masters of Medicine Series.) London, 1900.

PEACHEY, GEORGE C.: *A Memoir of William and John Hunter.* Plymouth; Printed for the Author, 1924.
LAENNEC, R. T. H.: *Translation of Selected Passages from " De l'Auscultation Mediate."* With a Biography by Sir William Hale-White, K.B.E., M.D. London, 1923.
MOORE, SIR NORMAN: *The History of St. Bartholomew's Hospital.* 2 vols. London, 1918.
TUKE, DANIEL H.: *Chapters in the History of the Insane in the British Isles.* London, 1882.
CHAPLIN, ARNOLD: *Medicine in England During the Reign of George III.* London, 1919.
BARON, JOHN: *The Life of Edward Jenner,* 2 vols. London, 1838.
MACFIE, RONALD CAMPBELL: *The Romance of Medicine.* London, 1907.
KEEN, W. W.: *Medical Research and Human Welfare.* London, 1919.

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